Psychological Impact of DAFNE Training in Adults with Type 1 Diabetes

by

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I certify that the thesis entitled:

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is the result of my own work and that where reference is made to the work of others, due acknowledgment is given.

I also certify that any material in the thesis which has been accepted for a degree or diploma by any university or institution is identified in the text.

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ABSTRACT

Subjective wellbeing (SWB) is remarkably stable across cultures and across nations. The long-term stability of the construct has led researchers to propose that individuals have a biologically predetermined set-point which, apart from transient deviations, remains a stable entity. It has also been proposed that a homeostatic system involving various internal and external buffering mechanisms keeps SWB in the positive range. However, this system is not immutable, and certain adverse stressors are associated with sustained homeostatic defeat, resulting in lowered wellbeing. Some research suggests that one of these stressors is chronic illness.

This thesis reports two studies. The first examines the SWB of people with a chronic illness and compares them to the general Australian population. After adjusting for demographic differences in income, intimate relationships, age, and employment, people with a chronic illness were found to have lower wellbeing than their healthy counterparts. These results suggest that chronic illness has a consistent and negative impact on SWB.

Study Two is prospective, investigating an education programme for people with Type 1 diabetes that relates to insulin adjustment. The programme, Dose Adjustment for Normal Eating (DAFNE), has only been available to Australians since 2005. This experimental research examines the impact of the programme on SWB, optimism, self-esteem, perceived control, and self-efficacy, as well as the negative affects of anxiety and depression. Results show that participation in DAFNE was associated with higher SWB, greater self-efficacy, and lower diabetes-related distress compared to a control group. These changes were sustained for 12-months after completion of the training.

The results of these two studies provide support for SWB homeostasis and the set-point theory. They suggest that whilst people with a chronic illness are likely to have lower wellbeing, these changes are not necessarily permanent. Powerful mastery experiences that enhance self-efficacy assist

homeostasis to restore the wellbeing in people with Type 1 diabetes back towards its normal range.

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“Every day a man must solve the problem
of widening the field of his life and adjusting his burdens.
These are too complex and numerous for him to carry himself,
but he knows that by being methodical he can lighten the load.
When the burdens are too complicated and difficult to manage,
he must understand the reason:
He has not found a system that will put everything in place and
distribute the weight he carries more evenly.
The search for this system is actually the search for the whole, for
synthesis.
It is our effort to create harmony, thanks to an interior adaptation,
in the heterogeneous complex of exterior material.”

Rabindranath Tagore (p. 25)

CHAPTER 1

INTRODUCTION

This thesis examines the subjective wellbeing (SWB) of people who are living with a chronic illness. Study One investigates these people in the context of the general Australian population. Study Two reports on the impact on SWB of an education intervention for people with Type 1 diabetes.

Subjective Wellbeing

Adapting to the vicissitudes of human existence is challenging. Having a system of "interior adaptation" as Tagore (1913) describes, is therefore necessary to maintain psychological equilibrium in the face of constant change. A better understanding of this system can assist in evaluating the psychosocial impact of adverse stressors such as chronic illness, and the important internal and external resources required to build resilience.

Early research in the 1960s, that investigated life quality, was primarily concerned with social indicators such as health, income, safety, and education (Land, 1999). At that time, quality of life was primarily an objective evaluation. But when researchers observed that wealthier people were not necessarily happier than their poorer counterparts, they began to realise that perceptions of life quality did not necessarily mirror objective living conditions (Strumpel, 1973). Consequently, subjective life quality or subjective wellbeing (SWB) became an area of research attention.

Cognitive Component of Subjective Wellbeing

Questions related to life satisfaction are the most commonly accepted method for measuring SWB (Diener, 1984). Surveys related to SWB have consisted of single items, most commonly of the form, "How satisfied are you with your life as a whole?" This question provides an abstract and personal assessment of wellbeing in a general sense (Cummins, Eckersley, Pallant, Van Vugt, & Misajon, 2003). However, because of its abstract nature, it is unable

to provide information about the specific components that may contribute to overall life satisfaction. Furthermore, the question is not very sensitive to change in a person's external situation. One way of overcoming these deficits is by measuring satisfaction with specific life domains such as health, relationships, safety, etc. A domain-based measure of subjective quality of life provides a personal but specific evaluation that is more sensitive to change and thereby complements the abstract and global question (Cummins et al.).

But, specific cognitions concerning evaluations of our lives are not isolated thoughts. Other cognitions, particularly in relation to what one has and what one wants, comparative judgments about one's present versus past experience, and comparisons with other people on multiple standards, are also believed to influence SWB (Michalos, 1985). The greater the discrepancy between, for example, what one has and what one wants, then the lower the SWB.

Affective Component of Subjective Wellbeing

As well as judgements about our lives and social comparisons, our reality is also interpreted through our moods and emotions, with happy individuals tending to rate their satisfaction with life higher than less positive people (Schwarz & Clore, 1983). This internal mood state has been described as core affect, and an extensive evaluation of this key construct has been provided by Russell (2003). He describes an object-free, conscious raw feeling, a "free-floating mood" (p. 145) that influences how we interpret our world. If asked, we can identify this mood state, but generally we are not conscious of it. Segal and colleagues (2002) have used the 'blue sky metaphor' to describe this steady sense of ourselves;

> "All our feelings, thoughts and sensations are like the weather that passes through, without affecting the nature of the sky itself. The clouds, winds, snow, and rainbows come and go, but the sky is always simply itself, as it were, a 'container' for these passing phenomena." (p. 172).

To explain this steady state in biological terms, researchers have proposed that core affect is a combination of two neurophysiological systems

related to valence and arousal (Posner, Russell, & Peterson, 2005; Russell, 2003). These two dimensions underpin the model of affective states conceptualised as a circumplex consisting of two axes: one comprising a pleasure-displeasure axis, reflecting positive and negative affect, and the other, an arousal-sleepiness axis that captures the dimension of activation (Russell, 1980). Russell has theorised that an individual's core affect, that is where one sits in the circumplex, is genetically determined, as well as being influenced by external factors such as our immune system, hormonal changes, circadian rhythms, etc.

The genetic influence on core affect has been supported by research showing that inherited personality traits are responsible for much of the variance of positive and negative affect. In their study of happy and unhappy people, Costa and McRae (1980) demonstrated that extraversion was linked to positive affect, while neuroticism was linked to negative affect. Further studies have supported this hypothesis by demonstrating a high correlation (r = .74), between extraversion and positive affect (Diener Eunook, Suh, Lucas, & Smith, 1999), and neuroticism and negative affect forming a single factor inseparable from each other (Fujita, 1991). Because of the impact of personality on affect, Diener and colleagues (1999) have claimed that personality "is one of the strongest and most consistent predictors of subjective wellbeing" (p. 279).

Twin studies have provided further support for the biological basis of SWB. In a study of 79 monzygotic (MZ) and 48 dizygotic (DZ) twins, the wellbeing of the pairs was tested when they were 20-years of age and again 10-years later (Lykken & Tellegen, 1996). Twin A's score at Time $_1$ was then correlated with Twin B's score at Time $_2$ and vice-versa. The authors found that the re-test correlation was .5, but there were important differences in the cross-time, cross-twin correlations. For the DZ pairs, this was not significant; however the MZ pairs demonstrated a correlation of .4 or 80% of the re-test correlation of .5. The authors interpreted the strong MZ correlation as evidence for the genetic determination of trait happiness. However, while there may be a genetic influence on wellbeing, a recent study has challenged

personality as the dominant driving force underpinning the construct (Davern, Cummins, & Stokes, 2007).

In Davern and colleagues' study (2007), the relationship between key emotional states (excited, satisfied, content, and happy), the 5-factor model of personality, cognitions associated with multiple discrepancy theory (MDT), and SWB were examined. The authors tested the primacy of personality in relation to SWB and measured the influence of the affective-cognitive composition of SWB. A model was developed in which the three positive affective states of excited, content, and happy were highly predictive of SWB. The authors, following Russell's lead (Russell, 2003), described these affective states as core affect. As expected, the analysis demonstrated significant overlap between core affect, personality, and MDT. But the three were not equally relevant in predicting SWB. Rather, the study found that core affect and cognitions related to MDT were significant predictors of SWB, with core affect explaining 64% of the variance in global life satisfaction. This study has therefore demonstrated for the first time that SWB is predominantly a measure of affect.

Other researchers have challenged the interpretation of the above study's findings. The principal objection relates to the conceptualisation of core affect. Moum (2007) believes that the terms used to define core affect, namely excited, content, and happy, are too closely related to SWB, and that the study's results are distorted because of multicollinearity. In response, Cummins and colleagues (2007) have stated that the highest correlation between any of the variables was .77. If variables were collinear it would be expected that zero-order correlations would exceed .9. As this is not the case, the authors stand by their interpretation that SWB is dominated by affect rather than personality or cognitions.

Whilst SWB appears to be a combination of cognitive and affective factors, the relative influence of cognitions, moods, and personality on the construct remains moot. In this thesis, SWB is conceptualised as satisfaction with life, as measured by specific domains, with these evaluative judgements grounded in a positive affective state.

Subjective Wellbeing and the Set-Point

Whilst there is not consensus on the relative importance of factors underpinning SWB, researchers are generally in agreement that positive and negative life events have minimal impact on the construct in the long-term (e.g. Suh, Diener, & Fujita, 1996). Of course there are adverse circumstances that overwhelm an organism's capacity for adaptation. Long-term unemployment (Lucas, Clark, Georgellis, & Diener, 2004), the death of a child (Wortman & Silver, 1987), and chronic pain (Penny, Purves, Smith, Chambers, & Smith, 1999), are just some of the adverse situations that can defeat wellbeing. However, in the absence of severely negative stressors, over time, wellbeing appears to remain stable.

This stability was highlighted by, Brickman, Coates, and Janoff-Bulman (1978), who in their landmark study, found that lottery winners were not significantly happier than controls. Whilst the study is often criticised because baseline wellbeing levels were not known, the counterintuitive results do provide some evidence for the stability of wellbeing and were the forerunner for other theories. The model of dynamic equilibrium (Headey & Wearing, 1989) and the set-point theory of wellbeing (Lykken & Tellegen, 1996) are examples of such theories, and propose a set-point or a baseline SWB to which an individual will return after adaptation to negative or positive life events.

The stability of SWB has also been demonstrated in population studies. These surveys generally show a negatively skewed distribution, indicating that wellbeing data are distributed in the positive range (Cummins, 1995). In order to compare studies that used different scales, data were converted to the standardised 0 – 100 range called percentage of scale maximum (%SM) (International Wellbeing Group, 2006). The formula is described in the Method section for Study One. Using such standardised data, a comparison of these studies shows that on a scale where zero represents complete dissatisfaction with life and 100 complete satisfaction, an analysis in 16 western countries demonstrated a mean of 75%(SM), with a standard

deviation of 2.74 (Cummins). A further study representing a broader range of 45 nations determined a mean-score range of 60-80% SM (Cummins, 1998).

The Australian wellbeing data (Cummins, Woerner, Gibson, Lai, Weinberg, & Collard, 2007) provides additional strong evidence for the stability of SWB. These data, collected over seven-years and involving over 35,000 participants, demonstrate a remarkable consistency, with only 3.1 percentage points separating the mean wellbeing scores from all 19 surveys conducted up to August 2008.

However, other researchers have challenged the stability of SWB (Fujita & Diener, 2005; Headey, 2008; Lucas, 2007). For example, using data from the German Socio-Economic Panel Survey (SOEP) from 1984-2000 (*N*=3,608), Fujita and Diener (2005) showed that over this period, approximately 10% of the sample had significant changes in their life satisfaction scores, the authors concluding that SWB does change for some people. Also,intentionally changing activities rather than circumstantial changes in one's life have been linked with increases in happiness (Sheldon & Lyubormirsky, 2006). The authors claim this is because hedonic adaptation is more likely to occur with circumstantial changes resulting in stable wellbeing levels. However, participants were only followed-up for 12-weeks, and whilst the authors' results look promising, this is insufficient time to make the claim that changing activities leads to sustainable changes to the SWB set-point. Other researchers defending the set-point theory have suggested that due to circumstances causing powerful emotional states, the mechanisms used to maintain SWB are defeated and these mood states predominate in a person's assessment of life satisfaction, rather than their core-affect set-point (Cummins, Lau, & Davern, in-press). This phenomenon does not necessarily mean that the set point has changed.

Notwithstanding the alternative views to the set-point theory, the robustness of SWB in Australia and across other nations and cultures (Cummins, 1998) has provided compelling evidence for the set-point theory of wellbeing. The theory proposes it is adaptive for wellbeing to be held in the positive range, so that individuals are motivated to live productive lives

(Lykken & Tellegen, 1996). Whilst transient changes in wellbeing are readily detected at the individual level, over time these deviations are resolved with the subsequent return of wellbeing to the genetically determined set-point (Lykken & Tellegen; Myers & Diener, 1995). Other researchers have extended the theory and suggested that the stability of wellbeing is due to a homeostatic system that maintains psychological equilibrium within a genetically predetermined range (Cummins).

The Theory of SWB Homeostasis

Homeostasis is a familiar term in physiology where there are many examples, from the subtle mechanisms that regulate the acid-base balance of the blood to the more obvious mechanisms regulating body temperature. These remarkable systems enable our internal milieu to remain tightly controlled in the face of a changing external environment (Solomon & Davis, 1988). Similar to physiological systems, it has been argued that the stability of SWB is also maintained by a regulatory homeostatic system, enabling the organism to maintain an optimum level of psychological functioning (Cummins, 2003; Cummins, Gullone, & Lau, 2002; Cummins, Lau, & Davern, in-press). Whilst SWB appears to be an affective and cognitive construct, according to some researchers the affective component is dominant (Davern, Cummins, & Stokes, 2007). It has been proposed that SWB homeostasis is defending this affective component, that is, core affect (Cummins, Lau, & Davern).

Additional support for SWB homeostasis comes from evidence that, like other homeostatic systems, SWB has a threshold below which the organism is at risk of pathology (Cummins, 2003; Cummins, Gullone, & Lau, 2002; Cummins, Lau, & Davern, in-press). Empirical evidence has been provided by Davern (2004), who investigated SWB and depression in 518 participants. Using the Depression sub-scale of the Depression, Anxiety, and Stress Scale (DASS) (Lovibond & Lovibond, 1995), her results showed that a DASS depression score of 11-15, indicating mild – moderate depression, was associated with a mean SWB score of 68%SM. Participants with scores in the moderate to high depression range scored a mean SWB of 53%SM. Therefore,

it would appear that a SWB score < 50 percentage points is strongly suggestive of depression. The interpretation of a score < 70 percentage points however is more complicated. This is because individuals have set-points in the positive range (i.e. > 50%SM), therefore, a score < 70%SM could indicate a low set-point or a higher set-point that is under threat (Cummins, Lau, & Davern).

The property of a critical threshold level is consistent with any homeostatic system, and demonstrates the system is not immutable. Given chronic exposure to sufficiently adverse stressors, SWB homeostasis can be overwhelmed, exposing the individual to a higher risk of experiencing depression (Cummins, Gullone, & Lau, 2002; Cummins, Lau, & Davern in-press). As mentioned earlier, this thesis examines the impact of one such stressor, chronic illness, on SWB homeostasis.

An Adverse Stressor: Diabetes Mellitus

As the experimental research in Study Two examines diabetes, it is important to provide a brief overview of this condition. Diabetes Mellitus is a disorder of carbohydrate metabolism and there are two distinct types. Type 1, the focus of this thesis, is an autoimmune disease where the body's own immune system destroys the beta cells in the pancreas. The beta cells produce insulin and their gradual destruction ultimately results in absolute insulin deficiency. The most common age of diagnosis is around puberty, and as there is no cure, once diagnosed it is essential to inject insulin for the remainder of one's life (Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 1998). Whilst the predisposition to diabetes is associated with particular genotypes, the concordance rate for identical twins is only 34% suggesting the presence of environmental factor(s) that trigger beta cell destruction (Olmos et al.1988).

Type 2 diabetes provides a very different presentation. The disease usually presents later in life and is characterised by resistance to insulin's action, and impaired insulin production (Drucquer & McNally, 1998). Unlike Type 1 diabetes, Type 2 is strongly inherited with the concordance rate

between monozygotic twins estimated at 96% (Medici, Hawa, Ianari, Pyke, & Leslie, 1999). Whilst the condition is inherited, lifestyle factors influence the age of diagnosis and the progression of the disease. Type 2 diabetes is often initially managed with healthy eating and exercise, however as the disease progresses, oral medication may be needed to improve insulin sensitivity and production, and eventually insulin injections are often required (Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 1998).

The chronic hyperglycaemia associated with both types of diabetes can have devastating consequences on health in the long-term. In particular, kidney failure, vision impairment, loss of limbs, heart disease and loss of sexual functioning are some of the long-term complications associated with the disease (Drucquer & McNally, 1998). The prevalence of diabetes in Australia is 7.5% and of those affected, approximately 10% experience Type 1 and the remaining 90% have Type 2 diabetes (Australian Institute of Health and Welfare, 2006; Dunstan et al. 2001).

Health Related Quality of Life

In chronic illnesses such as diabetes, the disease is not remediable, therefore, the emphasis is on care rather than cure. This has caused a shift in evaluating the benefits of medical interventions to not only include physiological benefits, but to also look more broadly and examine gains in quality of life (QOL). Whilst clinicians are generally not formally measuring QOL (Snoek & Skinner, 2002), in the diabetes literature, there is an emergence of quality of life research in people living with chronic conditions (Snoek, 2000).

In the medical literature, QOL has been conceptualised as Health-Related Quality of Life (HRQOL). Often the scales used in these studies are disease-specific, and measure symptoms relating to the condition in question. It is therefore arguable whether scores in the positive range indicate satisfaction with life and a positive state of being or merely an absence of pathology.

Further problems with HRQOL scales are evident because they relate to just one domain of a quality life, that of health, thereby disenfranchising other important domains (Cummins, Lau, & Stokes, 2004). Unfortunately for researchers who use these scales to measure QOL, the power of the health domain to predict happiness varies considerably. In a meta-analysis, Okun and colleagues (1984) found that health covaried moderately with SWB, having an effect size of 0.3. However, a more recent study identified a weak relationship between the two constructs (Michalos, 2004). The author reviewed data from 11 surveys in Canada, involving over 8,000 respondents. He found that in seven surveys, satisfaction with one's self-esteem was the strongest predictor of happiness ($\beta = 0.38$). Other top predictors were satisfaction with partner ($\beta = 0.30$), satisfaction with friendship ($\beta = 0.23$), and financial security ($\beta = 0.21$). Satisfaction with health was not a strong predictor ($\beta = 0.18$) and in five surveys its contribution was too weak to enter into the regression equation. Therefore, it is problematic to assume that health will strongly predict SWB.

An additional problem with HRQOL scales is that, as mentioned in the beginning of this introduction, there is a disparity between the objective and subjective measurements of a QOL variable (Strumpel, 1973). However in HRQOL scales it is often common practice to combine objective (relating to physical health) and subjective (relating to satisfaction with health) items into the one scale (for a discussion see Cummins, Lau, & Stokes, 2004). One example of such a scale is the World Health Organisation's Quality of Life scale (WHOQOL Group, 1994) in which questions regarding dependence on medicinal substances and medical aids (objective items) are combined with questions on satisfaction with personal relationships (subjective items). The scale encompasses the domains of health, environment, psychological, and social relationships. However, both the brief and extended versions have been further criticised because of the absence of important domains of standard of living and work productivity (Hagarty et al. 2001). The authors critiquing the scale highlight that because of this flaw in scale construction, the scale does not qualify as a valid quality of life measure, nor do they believe there is sufficient evidence regarding the efficacy of the "health" factor to measure HRQOL.

It is no wonder, given the different scales used to measure quality of life, that results from HRQOL research are sometimes at odds with research from the social sciences. One example relates to a cross-sectional study of 385 people with Type 1 diabetes (Aalto, Uutela, & Aro, 1997). The authors were investigating correlates of HRQOL and concluded that age was negatively associated with HRQOL. This finding makes sense when health is the overarching construct, because as people age, their health usually declines, and subsequently satisfaction with their health. But, the study fails to recognise that whilst adults may become more dissatisfied with their health as they age, due to SWB homeostasis, compensatory mechanisms from other domains assist to maintain their wellbeing within its normal range (Cummins, Lau, & Stokes, 2004). In the social sciences' literature, age has a small, but nonetheless significant positive association with wellbeing (e.g. Argyle, 1999). This discrepancy is one example of the lack of congruence between SWB and HRQOL.

In a systematic review of the impact of interventions on HRQOL in adults with diabetes, Zhang and colleagues (2004) found that the SF-36 used to measure HRQOL may have been "insensitive to HRQOL factors among diabetic patients with different comorbidities and complications" (p. 14).

Disease-specific HRQOL scales however, may be useful for researchers. As has been explained previously, subjective wellbeing is resilient and therefore not very sensitive to change because of homeostatic mechanisms keeping the construct in the positive range. Therefore these HRQOL scales can be useful when assessing the impact of interventions on perceived effectiveness of care and treatment, because they have been shown to be sensitive to change (Watkins & Connell, 2004). The studies presented in this thesis have used scales that are congruent with both the social sciences and medicine's conceptualisation of quality of life. However, in this thesis SWB is the overarching construct, meaning that chronic illness has been examined in the context of SWB rather than interpreting quality of life in the context of health.

Psychological Factors Related to SWB in People with Type 1 Diabetes

Within the QOL literature, the factors most strongly correlated with wellbeing are positive beliefs about the future (optimism), oneself, (self-esteem), and the amount of control and influence one has over one's life (e.g., Cummins & Nistico, 2002). In the diabetes literature these constructs are also associated with QOL (Eiser, Riazi, Eiser, Hammersley, & Tooke, 2001; Rose, Fliege, Hildebrandt, Schirop, & Klapp, 2002; Watkins, Connell, Fitzgerald, Klem, Hickey, & Ingersoll-Dayton, 2000) although as mentioned previously, QOL is usually operationalised as HRQOL. In this context, an additional concept that is frequently investigated in health behaviour research is self-efficacy (Leventhal, Weinman, Leventhal, & Phillips, 2007).

Self-Efficacy

Self-efficacy is generally regarded as a perception of one's capabilities, sense of agency or mastery to achieve a desirable outcome (Bandura, 1997). Research has demonstrated that self-efficacy is a dynamic construct enhanced by identifying and selecting realistic goals, problem solving to reduce barriers to achieving desired outcomes, and articulating outcome expectations (Kingery & Glasgow, 1989; Nied & Franklin, 2002). The empowerment approach used in diabetes education programmes has also been shown to improve self-efficacy (Anderson, Funnell, Butler, Arnold, Fitzgerald, & Feste, 1995). In this client-centred approach, the person with diabetes is the primary decision-maker, taking responsibility for their condition, and choosing their own behaviour-change goals (Funnell et al. 1991).

Assisting people with diabetes to initiate and achieve their own health-related goals have since become key roles for educators working in diabetes care (Michie, Miles, & Weinman, 2003). Clients benefit from self-care successes not only in relation to better health, but also because a "…positive cycle of optimism, activism, and further success..." (Peyrot & Rubin, 2007, p. 2437) can gather momentum. As self-efficacy has been shown to be an important predictor of achieving self-care goals (Kavanagh, Gooley, & Wilson, 1993) the construct has received considerable attention in the diabetes

literature. In Kavanagh and colleagues' study (1993), the authors found that self-efficacy explained 50% of the variance in healthy eating and exercise behaviour in people with Type 1 and Type 2 diabetes. A more recent study has provided further support for the association of self-efficacy with adherence to dietary recommendations ($\beta = .54$) in 638 individuals with diabetes (Senecal, Nouwen, & White, 2000).

As well as being associated with goal-directed behaviour, self-efficacy has also been linked with life satisfaction. In the study mentioned above, Senecal and colleagues (2000) found that both self-efficacy ($\beta = .15$) and autonomous self-regulation ($\beta = .34$), made independent contributions to life satisfaction, measured with the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffen, 1985). Autonomous self-regulation is a concept derived from Self-Determination Theory and describes internally driven motivation to perform intentional behaviours, rather than actions derived from external pressure (Deci, 1992). It would be expected that autonomy and competence would contribute to a greater sense of control over one's illness. As has been found in the QOL literature, having a sense of control and influence over one's life is a consistent predictor of SWB (e.g. Cummins & Nistico, 2002). It should then follow that perceived control over diabetes as well as self-efficacy would be related to SWB in people with diabetes.

Support for this prediction was found in a study of 235 people with diabetes, 96 of whom had Type 1 (Eiser et al. 2001). The authors found that both self-efficacy ($r = 32$) and beliefs regarding perceived control over diabetes ($r = .40$) were moderately associated with positive wellbeing. The Wellbeing measure used in this study was the positive wellbeing subscale from Bradleys's (1994) Well-being Questionnaire. The 6-item subscale incorporates coping, adjustment, happiness and enthusiasm for life. It is not diabetes specific and is therefore more likely to reflect SWB than the diabetes-specific HRQOL scales.

As well as being associated with SWB, beliefs related to personal control have also been shown to be significant predictors of health-related goals and behaviours (Ajzen, 1991). In Ajzen's Theory of Planned Behaviour,

perceived behavioural control, a concept developed from Bandura's self-efficacy, relates to an individual's beliefs about the presence of factors that may assist or hinder performance of the behavior (Ajzen). What is not clear from the diabetes research is whether having goals related to improving health is related to SWB. This is not the case in the QOL literature where striving for, and attaining personal goals, such as achieving better health, personal growth, and helping others, is consistently linked with greater SWB (Gollwitzer & Moskowitz, 2007; Schmuck & Sheldon, 2001).

It appears that there are a number of variables that need to be considered in predicting and understanding SWB in people with diabetes. It also appears from the diabetes and QOL literature that these variables are likely to be interrelated.

Quality of Life and Metabolic Control

The identification of the psychological factors associated with SWB in people with diabetes is important to help build resilience in individuals who must cope with a relentless and demanding disease. In the hope that improving QOL will also improve metabolic control, researchers have tried to identify a link between the two. To date, the lack of a consistent linear relationship between QOL and metabolic control (Aalto, Uutela, & Aro, 1997; Bradley, 1994; Eiser et al. 2001) has been frustrating but not unexpected given the low correlations between subjective and objective measures in QOL research. However, whilst a consistent relationship between SWB and glycosylated haemoglobin (HbA_{1c}) has not been identified, the same cannot be said for the correlation between an absence of wellbeing and poorer metabolic control.

Psychopathology and Type 1 Diabetes

Researchers suggest that psychopathology has a significant, negative impact on HbA_{1c}. In adults with diabetes, diagnosed with depression using a structured or semi-structured interview, a meta-analysis of 30 studies (10 studies related to Type 1 diabetes, N = 93) revealed depression to be associated with poorer metabolic control, $\beta = .17$ (Lustman, Anderson, Freedland, de Groot, Carney, & Clouse, 2000). This is not surprising when

some of the somatic symptoms are considered, e.g. changes in appetite may lead to over-eating, and low energy and fatigue are barriers to exercising daily (American Psychiatric Association, 2000). Lustman and colleagues report that depression accounts for approximately 3% of the variance in metabolic control. While this effect appears to be modest, using the binomial effect size display (BESD), the authors suggest that the treatment of depression could substantially increase the proportion of people achieving good diabetes control from 41% - 58%. The BESD is a tool used to estimate the practical importance of an effect without relying solely on r or r^2 values, the correlation is then presented as the difference in outcome rates between experimental and control groups (Randolph, 2005). The increase in the proportion of people achieving good control, proposed by Lustman and colleagues as a consequence of treating depression, is likely to be clinically significant and reinforces the need to better manage psychological problems in diabetes.

Not only do mood disorders worsen metabolic control, but the high prevalence rates of depression and anxiety in people with diabetes is further cause for concern. Prevalence rates were found to be double (41-49%) that of the general population (10-20%) in 634 outpatients attending a diabetes education programme (Peyrot & Rubin, 1997). In this study, the authors detected similar prevalence rates for anxiety and depression, women were more affected than men, and not surprisingly, higher rates were reported in those with three or more diabetes complications.

These results were confirmed in a meta-analysis of 42 studies (Anderson, Freedland, Clouse, & Lustman, 2001). The investigators found that people with diabetes were twice as likely to experience depression compared to individuals without diabetes. The findings appear to be robust as the review involved a combined total of over 20,000 participants, and studies were only included that identified depression severe enough to warrant treatment. It should be noted that whilst the prevalence of depression is high in diabetes, other chronic illnesses such as cancer (Bottonly, 1998) and heart disease (Carney, Freedland, Sheline, & Weiss, 1997; Frasure-Smith, & Lesperance,

2000) are also associated with similar rates of depression. Therefore chronic illness per se appears to be a significant challenge to SWB homeostasis.

When investigating psychopathology in diabetes, most researchers have found no difference in the prevalence of depression between people with Type 1 and Type 2 diabetes (Anderson, et al. 2001; Gavard, Lustman, & Clouse, 1993; Peyrot, & Rubin, 1997). However, Barnard and colleagues (2006) have hypothesised that people with Type 1 should have lower rates of depression compared to people with Type 2. Their rationale is based on the likelihood that those with Type 2 diabetes have a higher risk of co-morbidities such as obesity, heart disease, and hypertension as often these conditions go hand-in-hand with Type 2 diabetes. Furthermore, the onset of diabetes complications occurs much sooner after diagnosis in people with Type 2 diabetes, possibly because the condition has been pre-existing for a number of years prior to diagnosis. But, it could also be argued that people with Type 1 diabetes are the group with the greater propensity for depression. These people usually live with the condition for much longer because they are generally diagnosed when young, and hypoglycaemia is a much more significant burden in people with Type 1 diabetes.

To research their hypothesis, the authors reviewed 14 studies that investigated depression, in people with Type 1 diabetes only (Barnard, Skinner, & Peveler, 2006). The results confirmed previous studies demonstrating a significantly higher prevalence of depression in participants with Type 1 diabetes compared to their healthy counterparts. Not satisfied with these results, the authors excluded studies that used a questionnaire, or criteria from the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2000) to diagnose depression, rather than a diagnostic interview. The results then showed that the prevalence of depression was not significantly higher than in the non-diabetic groups. The authors justified their exclusion strategies by saying that questionnaire-only studies overestimate the prevalence of depression. (This may be due to items reflecting somatic symptoms that may confound mood states with physical symptoms of hyperglycaemia). However, other studies have shown that in

people with diabetes, cut-off scores ≥ 10 and ≥ 16 on the Beck Depression Inventory have sensitivities of .98 and .73 respectively, to detect depression (Lustman et al. 1997). These high sensitivities would appear to validate the use of questionnaires for this population.

Therefore it appears that anxiety and depression are significant problems for people with diabetes. To date the evidence would suggest that there is no difference in prevalence rates between people with Type 1 and Type 2 diabetes.

Treating Mood Disorders and Diabetes

The high prevalence rates of depression and anxiety in people with diabetes and the unequivocal link between good control and better long-term health (DCCT Study Group, 1993), strengthens the need to identify and treat mood disorders in people with diabetes.

In reality, there are considerable barriers to achieving this goal. There is evidence to suggest that only 20-30% of people with psychological problems such as anxiety and depression are recognised by diabetes care professionals (Pouwer, Snoek, Van Der Ploeg, Ader, & Heine, 2001). Several reasons have been proposed to explain this phenomenon. The stigma of depression often makes patients reluctant to admit they have a psychological problem, and the belief that anyone with diabetes is likely to be depressed, normalises the presence of depression in association with diabetes (Lustman & Clouse, 2004). Furthermore, diabetes-care professionals are not routinely trained to screen for and recognise depression. This general lack of awareness that depression and anxiety can be debilitating conditions, negatively impacting on physical health, make it much more likely that the primary focus of care is likely to be on medical problems (Lustman & Clouse).

Therefore, if the majority of patients with psychological problems and diabetes are not being appropriately diagnosed , then it is highly unlikely that these people will be referred to psychological services. Even if they are recognised, very few diabetes centres in Australia have access to publicly funded psychologists. It would therefore be useful to understand whether

diabetes education interventions can positively impact on both glycaemic control, and anxiety and depression. This is important not only because of the dearth of mental health professionals in diabetes care but also because anti-depressant medication may not be the best option. Researchers have found that such medication can compromise diabetes management. For example, selective serotonin reuptake inhibitors have been shown to suppress appetite and may also increase insulin sensitivity resulting in hypoglycaemia (Goodnick, Henry, & Buki, 1995). Further problems have been found with tricyclic antidepressants, with these drugs stimulating appetite thereby contributing to elevated blood glucose levels (Jacobson, 1996).

Other non-pharmacological treatments for depression, such as cognitive behavioural therapy (CBT), have not been investigated in people with Type 1 diabetes. Currently, there is only limited evidence for the benefits of CBT in people with Type 2 diabetes. Researchers have shown that the therapy, in combination with diabetes education, can achieve benefits for both mood and metabolic control in these people, compared to a control group, who only received the education intervention (Lustman et al. 1998). However, the small sample at the 6-month follow-up (N = 42), and the use of one therapist at only one centre, limits the generalisability of the study.

Further research also involving people with Type 2 diabetes and depression is the IMPACT study by Williams and colleagues (2004). This study investigated whether depression care in older adults (. 60-years) improved both mood and diabetes outcomes. Results demonstrated that the intervention improved depression but there were no benefits to glycaemic control and self-care relating to healthy nutrition and medication adherence.

The multi-centre research project described in Study Two of this thesis, will provide information regarding people with Type 1 diabetes, and will test whether a diabetes education intervention, delivered by a dietician and a nurse educator can simultaneously improve mood and diabetes control.

Conclusion

This thesis investigates chronic illness in the context of SWB, providing a bridge between medicine's view of quality of life and that of the social sciences'. Identifying some of the compensatory mechanisms that protect wellbeing in people with a chronic illness may broaden our conceptualisation of health, and broaden our evaluation of the effectiveness of health-care interventions.

CHAPTER 2

INTRODUCTION TO STUDY ONE

The year 2001 marked the beginning of a productive partnership between Australian Unity and Deakin University. This collaboration has resulted in an ongoing measurement of the wellbeing of the Australian population. This measurement involves quarterly telephone surveys of 2,000 people, new to each survey, and includes both rural and metropolitan areas. The present study reviews data from 16 surveys (2001-2006) and specifically examines the wellbeing of people with a chronic illness.

Impact of Context

The measurement of SWB, is of course, dependent on self-report. So an important methodological issue concerns the way in which a study is introduced, because this is known to influence the way people respond. For example, Smith and colleagues (2006) gave people with Parkinson's disease one of two introductions in relation to the purpose of the study . When told the study specifically concerned the wellbeing of people with Parkinson's disease, the participants' illness became a major determinant of their overall life satisfaction, with health satisfaction accounting for 39.7% of the variance in reported life satisfaction. In contrast, when participants believed the study concerned the wellbeing of people living in the eastern states of North America, health satisfaction only accounted for 11.5%. This shared variance of 11.5% is much in line with results from a meta-analysis, where self-reported health accounted for 9-14% in the variance of life satisfaction (Okun Stock, Haring, & Wittter, 1984) Therefore studying people in the context of their specific disease can artificially inflate the correlations between health and illness.

Whilst the above study concerns people with Parkinson's disease, it is likely that people with any chronic illness would respond in the same way, if similarly primed. Thus, in order to avoid such priming, the Australian Unity

Wellbeing Index is introduced in a neutral way, as a survey on how people feel about life in Australia. The present study should therefore give an unbiased view of the impact of chronic illness on SWB in the Australian population.

Domain Compensation

Intuitively we would expect chronic illness to have a negative effect on SWB. But, chronic illness is just one of many adverse events to which people may have to adapt throughout the course of their lives. To minimise the likelihood that people are overwhelmed by deteriorating health and other negative life experiences, researchers have proposed that psychological compensatory mechanisms buffer the effects of negative stimuli, thereby maintaining SWB under homeostatic control (Cummins, 1995; 1998; 2003; Cummins & Lau, 2006; Cummins & Nistico, 2002).

While homeostatic control has many facets, one cognitive mechanism is Domain Compensation. As the term suggests, when a source of challenge causes lower satisfaction in one or more domains, these decreases are compensated by higher satisfaction in other domains. The phenomenon was first reported by Best and colleagues (2000), who found that when farmers left the land, the contribution made by satisfaction with their productivity, to their overall wellbeing, declined. However, the contribution from satisfaction with their intimate relationships correspondingly increased, relative to those still farming. From this study, the authors hypothesised that Domain Compensation is a cognitive device used to maintain steady SWB under conditions of challenge. Therefore, if low satisfaction with health is evident in the present study, then an accompanying increase in satisfaction with other domains should be evident if Domain Compensation is operating.

As described in the general introduction, just like any physiological homeostatic mechanism, events sufficiently adverse and protracted can defeat SWB homeostasis, resulting in a decline in wellbeing (Cummins, 1995). When homeostasis fails, depression, representing a loss of wellbeing, occurs. As outlined previously, it has been proposed that as the level of life satisfaction

falls to below 70%, there is a shift from internal mechanisms, like Domain Compensation, to external circumstances exerting more influence on SWB because of homeostatic failure (Davern, 2004***).***

Objective and Subjective Assessment of Health

Due to homeostasis, it would be expected that the psychological consequences of having a chronic illness would vary, depending on the resilience of the individual, and the strength of the aversive properties of the chronic illness. However, when individuals are asked to evaluate their health, we would expect this domain to be more affected by chronic illness than other domains, because of the salience of ill-health to this particular aspect of life. While this holds true for some individuals, others will rate their health highly, irrespective of the presence of health problems. Interestingly these individuals are likely to live longer as self-rated health predicts longevity (DeSalvo, Bloser, Reynolds, He, & Muntner, 2005). Therefore, the relationship between physical health, an objective measure, and the perception of one's health, a subjective assessment is generally not predictably linear (Cummins, 1999).

The absence of a reliably linear relationship between physical illness and perceived health could be due to a number of factors (Cummins, Lau, & Stokes, 2004). The authors argue that if the chronic illness does not have obvious symptoms, then it is unlikely to be considered a problem by the person experiencing the condition, and as such, will probably have little impact on self-rated health. There may also be other positive aspects to one's health that are highly valued and therefore more influential on one's subjective assessment, than a diagnosis of a chronic illness. Such aspects could include energy levels, general fitness, functional capacity etc. Furthermore, there is a reciprocal relationship between SWB and satisfaction with health. Whilst the degree to which health and SWB are related is not clear, it can be said that wellbeing levels influence the subjective assessment of health and vice-versa.

Therefore, the relationship between objective health and perceived health, chronic illness and SWB, is not straightforward, and has been under investigation from medical and social scientists for many years. How each of

these entities impacts on the other is still contentious and whilst it is conceivable that a chronic illness could be sufficiently adverse to threaten wellbeing, it is unclear which, and under what conditions, chronic health problems defeat SWB homeostasis.

Disability Research and Subjective Wellbeing

Disability research provides some evidence of the negative influence of ill health on wellbeing. In a North American study, life satisfaction was measured for 675 people with physical and sensory disabilities (blindness, deafness), mental illness and chronic physical illnesses (Mehnert, Krauss, Nadler, & Boyd, 1990). When the authors' results are converted to Percentage of Scale Maximum scores (%SM) (see Method section) in which data are standardised onto a 0-100 scale, people with a disability score 68%SM and those who are not disabled 84%SM. As the 68 percentage points is below the threshold of 70 percentage points, this score gives an indication that a higher than normal proportion of participants with health problems may have been experiencing homeostatic failure.

The study also highlighted an age effect, as the older that people were when they developed the disability, the lower their life satisfaction (Mehnert et al., 1990). Perhaps the development of a health problem earlier in life gives people a greater opportunity to adapt to the demands of living with a disability. The authors also found that people with a single condition were more satisfied than those coping with two or more health problems. This is not surprising as the presence of co-morbidities is an added complication, requiring greater internal and external resources to manage the increased complexity, thereby depleting homeostatic resources, and resulting in lower SWB.

In people with diabetes and complications such as retinopathy and nephropathy it has been found that the presence of these conditions is significantly associated with lower quality of life (DCCT Study Group, 1996).

There were also differences depending on the type of disability, with those experiencing chronic illnesses or physical disabilities significantly less

satisfied, compared to people with a sensory disability (Mehnert et al.). Without additional information, it is difficult to interpret this finding. However, a plausible explanation is the possibility that one sense (e.g. hearing), may compensate for another (e.g. vision impairment), thereby attenuating the negative impact of the sensory deficit (Lee, Truy, Mamou, Sappey-Marinier, & Giraud, 2007).

The above study also found that relationship status, age, income, and employment were correlated with life satisfaction. However, the authors did not control for these variables in their analysis. It is therefore difficult to know how much of an impact these various health problems might have been having when the key variables known to influence SWB were not taken into account.

Severe disability can also occur with multiple sclerosis (MS), and recent research involving 381 people with MS, reinforces findings from other studies that chronic illness negatively impacts on wellbeing (McCabe & McKern, 2002). In this Australian study, people with MS scored lower on all domains than people in the general population without the condition. However the results need to be interpreted with caution because the authors chose the World Health Organisation Quality of Life – 100 scale (The WHOQOL Group, 1994) to measure SWB. Ironically, this scale was chosen because of its capacity to measure both objective and subjective dimensions. But, as mentioned in the general introduction, it is this feature that has been identified as one of its flaws (Hagarty et al., 2001). Therefore the impact of MS on SWB cannot be established from this study.

Disease-Specific Impact on Subjective Wellbeing

Contrasting results to the above reports, regarding the negative impact of chronic illness on SWB, were found in a large population study involving over 5,000 elderly Dutch people (Gertrudis, Kempen, Ormel, Brilman, & Relyveld, 1997). The authors investigated people with asthma, heart disease, hypertension, diabetes, rheumatoid arthritis, migraine and dermatologic disorders (psoriasis and eczema). Participants were compared to people without the particular disorder and to those without any medical condition.

The results demonstrated that diabetes and hypertension had the least impact on SWB whilst migraine and back problems had the most negative influence. Unlike the Mehnert et al. study (1990), the authors concluded that chronic medical conditions had only minimal impact on SWB. This conclusion was reached in spite of significant differences in wellbeing between people with a chronic illness and healthy controls. The rationale for the authors' conclusion was because differences in wellbeing were less than differences in other areas such as role, physical, and social functioning. But, if changes to wellbeing are strongly resisted because of homeostatic mechanisms, then when changes do occur they are very meaningful (Cummins et al., 2004), whereas physical functioning for example, is much more sensitive to changes. Therefore the inference that chronic illness had minimal impact on SWB because of adaptive processes may be incorrect.

There are a number of other limitations in this study that warrant comment. The authors controlled for age, gender, education level and the number of co-morbid conditions. However, given that the study's participants were elderly people and the influence of education level declines with age (Okun et al., 1984), it may have been prudent to control for the more influential variables on life satisfaction such as relationship status, and income. Problems are also apparent with their operationalisation of SWB. The authors used the Medical Outcomes Study Short-form General Health Survey (SF-20) (Stewart, Hays, & Ware, 1988). This comprises 20-items representing six domains; physical functioning, role functioning, social functioning, health perceptions, bodily pain, and mental health. The latter domain was used to represent SWB. However, of the five items that make up the mental health domain, three reflect psychopathology, one item represents calmness, and the fifth item asks participants about their happiness levels. Therefore high scores on the mental health domain of this scale are highly likely to represent an absence of pathology rather than SWB.

More compelling evidence regarding the impact of chronic illness on SWB is provided in a population study using data from the National Health Survey (Ampon, Williamson, Correll, & Marks, 2005). This survey is

conducted tri-annually by the Australian Bureau of Statistics, and researchers studied over 14,000 people aged 18-64 years. The authors investigated life satisfaction, self-rated health, and psychological distress in people with asthma, arthritis, and diabetes, compared to the rest of the population. The authors found that a higher proportion of people with asthma reported lower life satisfaction, poorer self-rated health, and higher psychological distress, compared to people without the condition. Asthma also seemed to have a greater influence on these three constructs compared to diabetes, but less impact compared to arthritis. The analyses were adjusted for age, gender, smoking status, socio-economic status, and body mass index, but not for relationship status. This is an important omission as there is general consensus in the QOL literature validating intimate relationships as an important contributor to SWB (Argyle, 1999).

It is interesting that diabetes had significantly less impact on quality of life than asthma, given the high prevalence of depression reported in people with diabetes (Lustman, Anderson, Freedland, de Groot, Carney, & Clouse, 2000; Anderson, Freedman, Clouse, & Lustman, 2001). Further support for diabetes having less impact on wellbeing than might be expected, is found in a study of people in a rural British Columbian community (Grigg, Thommasen, Tildesley, & Michalos, 2006). In this study, comparisons of self-rated health and life satisfaction were made between people with diabetes and those without the condition (Grigg et al.). The authors developed a morbidity-rating scale where people with diabetes were scored according to the number of co-morbidities present. The maximum morbidity rating was 24. People with diabetes were then subdivided into low and high morbidity-rating groups. Thus, three groups were compared. Those without diabetes (N=846), those with diabetes and a low morbidity rating of 1-2 (N=66) and those with diabetes and a high morbidity rating, indicated by a score of 2.5 – 4.0 (N=26).

Converting scores to a percentage of the scale maximum, satisfaction with health for no diabetes, low-morbidity diabetes, and high-morbidity diabetes were 65, 55, and 56 percentage points respectively. Satisfaction with life as a whole was standardised to 74, 74, and 78 percentage points

respectively. These standardised scores support the authors' conclusion that people with diabetes had significantly lower self-rated health. However, their life satisfaction scores were no different from people without diabetes.

Unfortunately, the study is compromised by large disparities in sample sizes between the groups. It would be expected that such a disparity would result in substantial differences in variance between the groups. Yet no comment was made about this issue. Given there are fewer people with diabetes in the study compared to those without, it made little sense to further subdivide the diabetes group, thereby reducing the power of the study to detect between-group differences. The subdivision seems even less justified considering the difference between the low and high morbidity groups is small, with mean scores of 2 versus 4 out of a maximum score of 24. If the demarcation between the high and low-morbidity groups was meaningful, we would expect those with a higher morbidity rating to be less satisfied with their health compared to those with a lower rating, but this was not the case. As the study detected lower self-rated health for people with diabetes but no differences in overall life satisfaction, it would have been interesting to see whether the people with diabetes compensated for their lower scores on health by reporting greater satisfaction with other domains.

It is apparent that different chronic illnesses have quite disparate features. Some are associated with pain and fatigue, others**,** such as diabetes, are associated with a complex self-management regimen, and a high risk of developing complications that can erode life quality. Diabetes has featured in epidemiological studies that have shown the illness threatens SWB homeostasis. Yet some of the research reviewed above (Gertrudis et al., 1997; Ampon et al., 2005; Grigg et al., 2006) suggests diabetes has less of an impact on wellbeing then would be expected, given the high prevalence of depression reported in this group. It may be that when people with diabetes are compared to those without any chronic condition the disparity in psychological health is very evident**.** However, other chronic conditions may be just as, or even more debilitating to psychological health as diabetes.

Adaptation to Ill Health

Many research studies, such as those reviewed above, use a cross-sectional design. However, surveying people at multiple time-points provides a greater understanding of whether people adapt to their illness over time. Verbrugge and colleagues (1994) used a longitudinal design to measure the wellbeing of 165 people hospitalised for the treatment of a chronic medical condition. Participants were measured after discharge from hospital, and eleven times during the following two-years. (Verbrugge, Reoma, & Gruber-Baldini, 1994). A range of conditions including hip fracture, cerebrovascular accident, diabetes, arthritis, pulmonary disease, and heart failure were present amongst the people studied. The results showed that wellbeing improvements were greater for those with a hip fracture, which is to be expected, as fractures are acute problems that normally resolve, unlike chronic illnesses that worsen over time. The wellbeing trajectory plotted by the authors indicated that wellbeing improved for 7 to 9-months after discharge, following which it generally declined. This trajectory does not support the theory of SWB homeostasis from which it would be expected that adaptation to ill health would continue in the longer term.

However, the lack of evidence for SWB homeostasis in the above study may be due to the scale used to measure SWB. The authors used the Index of Wellbeing (Patrick, Bush, & Chen, 1973) a scale that primarily focuses on health-related items such as mobility, physical activity, social activity, and symptoms, rather than the established life-domains related to SWB. The results are therefore more likely to reflect disease symptoms and physical functioning rather than SWB per se.

The seminal article by Brickman, Coates, and Janoff-Bulman (1978), mentioned in the general introduction, was conducted many years ago but is worth considering because it is often cited as evidence that people can adapt to dramatic and negative changes to their health status. While this study also examined the positive impact of winning the lottery, it is the impact of injuries sustained in accidents that relate to the discussion here. The victims' injuries were catastrophic, resulting in paraplegia (N = 11) or quadriplegia (N = 18).

However, the authors proposed that after the initial threat to SWB, adaptation would eventually occur. Whilst the accident victims' rated their happiness lower than lottery winners (understandably) and healthy controls, the authors were surprised that their happiness was not rated lower than that reported, and believed this was evidence of adaptation. However, when the results are standardised to a percentage of score maximum, the findings suggest otherwise.

The accident victims' mean happiness score of 2.96 is equal to 59.2 percentage points when standardised. This score is considerably below the threshold of 70.0, which, it has been proposed, indicates homeostatic failure. Not surprisingly, the accident victims were also significantly less happy than people in the control group, who managed a happiness score of 76.4 percentage points. Whilst it is not possible to ascertain the accident victims' pre-accident happiness score, it is highly likely that it would have been above 59.2, in keeping with other studies on SWB in Western countries (Cummins, 1995). Rather than being used as evidence of hedonic adaptation, the study could be said to highlight the negative impact of severe disability on SWB homeostasis, thereby supporting the research on reduced life satisfaction and health problems.

Conclusion

In conclusion, the research generally supports the idea that people with a chronic illness have lower wellbeing than their healthy counterparts, as might be expected. However, the major flaw in much of the work is the conceptualisation of wellbeing, its subsequent measurement, and some of the interpretations that follow. The development of health-related quality of life measures has seen the rise of researchers mistakenly equating health and wellbeing (Michalos, 2004). Whilst health and wellbeing are related, they are nonetheless distinct entities. In some fields of endeavour labels are not so important. As Juliet says to Romeo, "What's in a name? That which we call a rose by any other name would smell as sweet" (Shakespeare p. 35). For Juliet, her lover's surname was irrelevant and made no difference to her ardour. But in science, the label is important because the name given to an entity

influences how it is measured. If a rose is labelled a box, and assessed with a tape measure, information about its physical dimensions would be obtained. But, its most defining features of colour, beauty, and fragrance would be missing. This is analogous to what happens when wellbeing is assessed with measures relating to health. The result is reductionist, with the information relating to just one dimension of life quality.

The present study conceptualises wellbeing as a positive state of being and satisfaction with life in general (Cummins et al., 2004). Using Australian population data, the study compares this entity between people with a chronic illness and people who are healthy. Whilst not everyone experiencing poor health is unhappy, this study nevertheless proposes that chronic illness has a lasting and negative impact on SWB.

Hypotheses for Study One

This study proposes that;

1. People with a chronic illness will have lower SWB, compared to their healthy counterparts.

2. Due to SWB homeostasis, low satisfaction with health will be compensated by higher satisfaction with other quality of life domains.

3. People with diabetes will have a SWB score similar to people with other chronic conditions.

CHAPTER 3

METHOD FOR STUDY ONE

The purpose of this investigation is to determine the impact of chronic illness on subjective wellbeing. Specific conditions are analysed and in particular, people with diabetes are compared with people experiencing other chronic illnesses.

Participants

The sample used in this study is a subset of approximately 30,000 people who completed the Australian Unity Wellbeing Index from 2001 – 2006. The people in this subset were selected because they had responded to the following questions during a telephone survey; "Do you have a medical or psychological condition that makes you visit the doctor on a regular basis?" If respondents answered "yes" they were asked to indicate their major condition from a list that included arthritis, anxiety, asthma, heart problems, hypertension, cancer, diabetes, and depression. If none of these conditions were applicable, "other" was used to define the condition. Of the 11,785 who responded to this question (it was only asked in some surveys), 29% (N=3,416) had a medical condition and 71% (N = 8,368) did not.

Materials

Subjective wellbeing is measured using the Personal Wellbeing Index (PWI) (Cummins, 2003). The index uses an 11-point (0-10) end-defined scale with "0" being completely dissatisfied and "10" being completely satisfied. The PWI consists of seven domains each of which describes an aspect of life that can be measured both objectively and subjectively (International Wellbeing Group, 2006). The domains also represent effect indicator variables rather than causal variables (the importance of this distinction has been explained in the main introduction). The PWI score is obtained by averaging scores on the seven domains. The scale has demonstrated consistent reliability in Australia from 19 surveys with Cronbach's alpha between .70 and .85, and

a high level of sensitivity between different demographic groups (Cummins, Woerner, Gibson, Lai, & Weinberg, 2007; International Wellbeing Group).

Construct validity of the scale has been ascertained by research demonstrating that each domain of the PWI, except for 'Safety', contributes unique variance when the domains are collectively regressed against 'Satisfaction with life as a whole': The domain of Safety is retained in the scale because it makes a unique contribution in other countries (International Wellbeing Group){Group, 2006 #386}. In relation to convergent validity Thomas (2005) demonstrated a correlation of .78 with the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffen, 1985).

Data are converted from a 0-10 response scale to a 0-100 point scale. The values derived from this process are called 'percentage of scale maximum' (%SM) (International Wellbeing Group, 2006). In studies that have used a different response scale, such as a 0-5 rating, the values obtained can be converted to the standard 0-100%SM by the formula below.

(Equation 1)

$$\%\,SM = \frac{X - k^{min}}{k^{max} - k^{min}} \quad X\ 100$$

Where X = the mean score to be converted; k^{min} = the minimum score possible on the scale; k^{max} = the maximum score possible on the scale

In the present study the conversion was achieved by shifting the decimal point to the right. Therefore a PWI score of 6 becomes 60%SM.

CHAPTER 4

RESULTS FOR STUDY ONE

Preparation of the Data

Prior to statistical analyses, the data were examined through SPSS Version 15.0 for accuracy of data entry, missing values, assumptions of normality (i.e. Kolmogorov-Smirnov) and homogeneity of variance (i.e. Levene's test). It was found that scores for categorical and continuous variables all fell within the possible range. Missing values were managed by excluding cases only if they were missing data required for the specific analysis. The large difference in sample sizes resulted in a violation of the homogeneity of variance assumption in all analyses. When this assumption is violated, there is an increased Type 1 error rate and an inflated alpha level (Tabachnick & Fidell, 2001). One strategy recommended to manage this violation is randomly deleting cases until the group sizes are equal. This strategy was not employed in this situation because the unequal *N* reflects a true difference in the Australian population, namely those with a medical condition are fewer than those without an illness across the adult lifespan. Therefore artificially equalising the sample sizes would distort these real differences (Tabachnick & Fidell). As an alternative, it was decided to adopt the strategy recommended by Tabachnik and Fidell, using the more stringent alpha level of .01, to minimise the Type 1 error rate associated with the violation of homogeneity of variance.

Another violation related to skewness. Subjective wellbeing scores have consistently been found to be in the positive range over a number of studies (Cummins, 1995). Therefore SWB data are normally, negatively skewed. The level of skewness for this study is -.95. As the sample of participants is large, this degree of skew is unlikely to make a substantive difference to the analysis (Tabachnick & Fidell, 2001). Therefore, transforming the data would achieve limited benefit, and it was decided not to change the shape of the natural distributions.

Descriptive Statistics

The characteristics of people with a medical condition and those without are presented in Table 1.

Table 1

Participant Characteristics

	Medical Condition			
	Yes	*N*o	χ^2 *df*(1)	*p*
N	3416	8368		
Age (years)	57.5 (16.1)	44.7 (16.1)		
Relationship Status (%)				
Married	56.2	57.8	2.60	.12
Defacto	4.8	8.4	46.40	.00
Never married	10.5	19.5	138.16	.00
Divorced	10.7	6.5	60.27	.00
Separated	3.5	3.1	1.61	.21
Widowed	14.3	4.8	313.67	.00
Unemployed (%)	5.5	3.1	32.90	.00
Income (%)				
< $15K	22.3	7.9	333.60	.00
$15K - $30K	27.9	15.7	164.26	.00
$31K - $60K	23.8	30.8	39.93	.00
$61K - $90K	14.4	22.2	64.67	.00
>$91K	11.5	23.4	150.97	.00

From the above table it is evident that participants with a medical condition are on average older, earning a lower income, and more likely to be unemployed (this category does not include retired people but rather those looking for work who are unable to find employment). When the married and defacto categories are combined it is also apparent that people with a medical condition are less likely to be partnered, and more likely to be divorced. Chi-square tests of independence were used to explore the relationship between medical condition and these categorical variables. Apart from the categories of “married” and “separated”, all other differences are significant. In the case of age, a one-way analysis of variance (ANOVA) was used and a significant difference was also detected $F(1, 11717) = 1536.9$, $p = .00$.

The Influence of Demographic Factors on SWB

The differences in the above demographic variables between people with and without a medical condition are important. As previously mentioned, the research literature has identified a relationship between these demographic variables and SWB. The existence of a relationship in the present study between the demographic variables and PWI would mean that in future analyses, the demographic variables would need to be used as covariates. To assess if this relationship was present, the means and standard deviations for the PWI were calculated for each of the demographic variables (Table 2). Given that data on the demographic variables were available for a much larger sample, it was decided to use all the population data of approximately 30,000 cases. This larger sample therefore incorporated the subset who provided information about whether they had a medical condition. A series of one-way between groups ANOVAs were then conducted and are also shown in Table 2.

Table 2

Demographic Variables from Population Data X PWI

Variable	*N*	PWI [Mean (SD)]	*F*	*df*	*p*
Age Group (years)	29779		56.18	6, 29772	.00
18-25	3040	74.00 (11.57)			
26-35	4516	74.27 (11.66)			
36-45	6133	74.28 (12.44)			
46-5	6060	73.96 (12.98)			
56-65	4882	75.59 (12.44)			
66-75	3256	77.00 (12.01)			
76+	1892	78.32 (11.82)			
Relationship Status	18831		268.03	5, 18825	.00
Married	10950	77.37 (10.84)			
Defacto	1372	74.87 (11.21)			
Never Married	3192	71.48 (12.80)			
Separated	580	68.59 (14.72)			
Divorced	1393	68.35 (14.89)			
Widowed	1344	76.53 (13.24)			
Income ($)	21,843		148.24	4, 21838	.00
<15K	3222	71.57 (15.12)			
15K – 30K	4460	73.56 (13.34)			

Variable	*N*	PWI [Mean (SD)]	*F*	*df*	*p*
31K – 60K	6542	74.73 (11.63)			
61K – 90K	4088	76.46 (10.69)			
>91K	3531	77.96 (9.65)			
Unemployed	12568		307.82	1, 12566	.00
Yes	548	75.63 (11.93)			
No	12020	66.27 (17.32)			

Table 2 shows that a significant difference exists between the levels of all four variables and the PWI. Post-hoc comparisons were also conducted. Given the violation of homogeneity of variance, the more conservative Games-Howell procedure was used for this purpose (Field, 2005). These comparisons indicated that older people, in a relationship, with a higher income and employed had a significantly higher PWI. Future analyses will therefore need to adjust for the differences between those with a medical condition and those without on the above demographic variables, by using them as covariates.

Subjective Wellbeing and Chronic Illness

To assess the impact of chronic illness on SWB, a between-groups ANOVA, tested the difference in PWI between those with and without a medical condition. The means and standard deviations are included in Table 3. As expected, the group without a medical condition has a significantly higher PWI, F (1,11440) = 250.1, p=.00. An analysis of covariance (ANCOVA) revealed that this difference remains significant even after adjusting for the demographic variables of age, relationship status, income, and unemployment, F (11,6675) = 99.74, p = .00

The means and standard deviations of the PWI and each domain are shown in Table 3. A multivariate analysis of variance (MANOVA) was used to investigate differences in domain scores. Preliminary testing found a highly significant Levene's test (p=.00), indicating the homogeneity of variance assumption is again violated. The distributions were also negatively skewed, ranging from -.76 for community connectedness to -1.51 for personal relationships. Because of these violations, the more robust Pillai's Trace was

the multivariate test chosen (Tabachnick & Fidell, 2001). Pillai's criterion indicates a significant multivariate main effect F (7, 11,434) = 345, p = .00.

Table 3

Multivariate ANOVA for Mean Domain Scores X Medical Condition

	Medical Condition				
	Yes [Mean (SD)]	No [Mean (SD)]	F (1, 11422)	p	Partial Eta^2
PWI	72.18 (14.10)	76.22 (11.61)			
N	3276	8166			
Domains					
N	3271	8160			
Standard of living	76.05 (18.72)	78.15 (16.16)	35.93	.00	.00
Health	62.79 (21.96)	79.89 (15.81)	2158.00	.00	.16
Achieving in Life	70.45 (21.30)	74.32 (17.51)	100.31	.00	.01
Personal relationships	77.67 (24.30)	79.36 (21.01)	13.64	.00	.00
Safety	77.30 (19.69)	79.91 (16.61)	51.67	.00	.00
Community connectedness	71.06 (21.07)	70.42 (19.38)	2.37	.12	.00
Future security	69.89 (21.67)	71.50 (19.09	15.36	.00	.00

As shown in Table 3, significant differences between the two groups were detected for all domains except community connectedness. It is also evident when looking at the effect size (partial eta squared), that the health domain accounts for 16% of the variance in PWI. Thus, as expected, the domain of health is exerting the most influence on the difference between the two PWI scores. The other domains are also lower for those with a medical condition, with the exception of community connectedness

In order to put these results in perspective against normative data, the mean PWI and mean domain scores for people with and without a medical condition are plotted against the general population (Figure 1). Each normative band of values (vertical grey bars) shown in Figure 1 is calculated by using the population mean scores of the first 16 Australian Unity Wellbeing surveys as data. Each bar represents two standard deviations around their grand mean

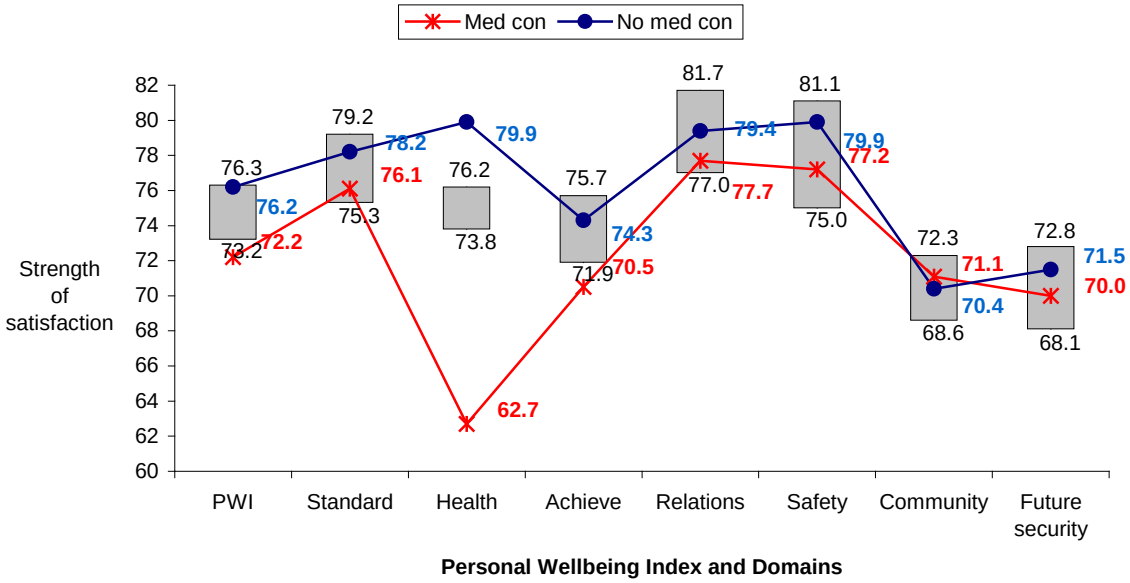


Figure 1. Comparison between those with a medical condition and those without against normative data.

Figure 1 demonstrates that for those with a medical condition, mean scores for the PWI are not just lower than for those without a medical condition, but are also lower than the normative range. This also applies to the two domains of health and achieving in life. However, all of the other domains remain within the normal range for the population even though they differ between the medical/non-medical condition groups. Clearly, therefore, the main domain affected by poor health, apart from the health domain itself, is achieving in life.

Domain Compensation

As the previous results have demonstrated, chronic illness significantly reduces satisfaction with health. The following analyses were therefore conducted to detect whether some domains were rising to compensate for the lower mean scores on the health domain; a phenomenon described by Best et al (2000). To test for domain compensation, the relative contribution of each domain in the construction of the PWI was calculated as follows; (mean domain ÷ sum of all mean domains) x 100. Each domain was thereby converted to a percentage of total satisfaction for each respondent (Best et al.,

2000) and their relative contribution for those with a medical condition and those without is shown in Table 4.

Table 4

Percentage Contribution of the Domains to the PWI Score

	Percentage Contribution of Mean Domain Scores to PWI [Mean(SD)] Medical Condition				
Domains	Yes (*N* = 3276)	No (*N* = 8166)	*F* (1)	*p*	Partial Eta^2
Standard of living	15.13 (3.45)	14.68 (2.66)	57.16	.00	.01
Health	12.45 (4.21)	15.10 (3.13)	1360.97	.00	.11
Achieving in Life	13.87 (4.04)	13.90 (2.79)	.21	.65	.00
P. Relationships	15.31 (4.90)	14.83 (3.70)	33.00	.00	.00
Safety	15.44 (4.09)	15.07 (3.08)	27.73	.00	.00
Comm. Connectedness	14.11 (4.03)	13.14 (3.23)	181.58	.00	.02
Future security	13.70 (3.56)	13.29 (2.92)	38.84	.00	.00

Abbreviations: P. Relationships = Personal Relationships; Comm. Connectedness = Community Connectedness

To detect differences in the contribution of each domain, a MANOVA was used. Pillai's criterion reveals a significant multivariate main effect, $F(1, 11{,}435)=242.14$, $p = .00$. Table 4 demonstrates significant univariate effects for all the domains except for Achievements. It is therefore evident that for participants with a medical condition, all domains except Health and Achievements make a greater contribution to the overall PWI compared to participants without a medical condition.

Thus, for people with a medical condition, five domains appear to be compensating for the very low satisfaction they are experiencing from their health. It is also evident the domain of Community Connectedness, compensates more than the other domains.

Specific Medical Conditions

The analyses to this point have examined participants with and without a medical condition and compared both groups with normative data from the Australian Unity Wellbeing Index. However, it is not known whether particular medical conditions differentially affect SWB. As mentioned in the

method section, participants who declared they had a medical condition identified their primary concern from a list of eight conditions and a category of "other" if none of the eight were appropriate. The following analyses examine the PWI associated with the eight medical conditions and, given the high prevalence of depression amongst people with diabetes, specific comparisons have been made between diabetes and the other illnesses.

To obtain an impression of the impact of the different medical conditions on SWB, Figure 2 shows the normative range for PWI, represented by the horizontal bar, and the mean PWI for the different medical conditions.

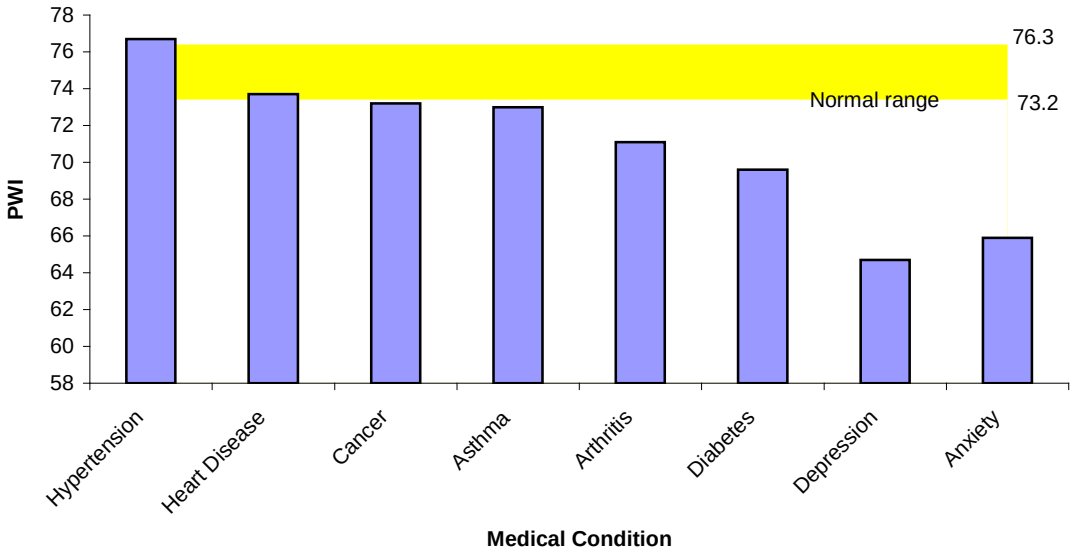


Figure 2. Mean PWI X different medical conditions compared to normative range.

From Figure 2 it is evident that hypertension and heart disease are conditions that appear to have minimal impact on SWB. Whereas the mean PWI for people with arthritis, asthma, diabetes, depression and anxiety all fall below the normative range.

Table 5 shows the mean (SD) PWI for these different medical conditions.

Table 5

Mean (SD) for PWI X Medical Conditions and Difference in PWI between other Conditions and Diabetes

		PWI Scores		
Condition	*N*	Mean (SD)	PWI_{Other} minus $PWI_{Diabetes}$	*p*
Anxiety	62	65.85 (18.86)	-3.77	.61
Arthritis	384	71.05 (15.31)	1.42	.95
Asthma	159	72.97 (11.61)	3.34	.33
Cancer	218	73.21 (12.74)	3.59	.14
Depression	218	64.71 (16.76)	-4.92	.01
Diabetes	220	69.62 (14.19)		
Heart Disease	390	73.66 (12.64)	4.04	.02
Hypertension	638	76.65 (12.30)	7.03	.00
Other	967	71.66 (13.88)	2.04	.56

It is evident that mean PWI scores for depression, anxiety, and diabetes all fall below the threshold for homeostatic failure of 70.0 percentage points. Table 5 also shows the difference in mean PWI scores between diabetes and the other conditions. A negative difference means that the PWI score for a particular condition is lower than the score for diabetes.

Interestingly, it is also evident from the above table that as the PWI reduces, the variance increases as indicated by the standard deviations. This would appear to support the theory that SWB is under homeostatic control. As SWB becomes threatened and begins to fall below the set-point range, various factors are mobilised to defend SWB homeostasis. These factors such as cognitions, self esteem etc., described in the context of homeostasis as resilience (Cummins, Gullone, & Lau, 2002; Cummins & Nistico, 2002), are likely to be highly variable amongst individuals. Therefore, when SWB is being defended, a greater variation in PWI would be expected, compared to when individuals' resilience is not being tested.

To determine whether the differences in mean PWI were significant, a one-way ANOVA was conducted with PWI as the dependent variable, and the type of medical condition the independent variable, with its nine levels. A

statistically significant difference is detected for the medical conditions F (8, 3,247) = 20.23, p =.00.

In order to investigate the impact of diabetes, post hoc comparisons using the Games-Howell procedure revealed that those participants with diabetes had a significantly lower mean PWI compared to those with heart disease and hypertension, and higher scores compared to those with depression. No significant differences were detected between diabetes and the remaining medical conditions (anxiety, arthritis, asthma, cancer, and other).

To assess for differences amongst the medical conditions in the seven domains of the PWI, the means (SD) were first calculated (Table 6).

Table 6

Mean (SD) Domain Scores for the Different Medical Conditions

Medical Condition	Standard of Living	Health	Achievements	Personal Relationships	Safety	Community Connectedness	Future Security
Anxiety	69.52 (23.22)	61.94 (21.72)	64.03 (25.70)	67.74 (30.00)	69.84 (23.71)	65.00 (24.75)	62.90 (25.82)
Arthritis	75.18 (19.47)	57.27 (22.72)	69.71 (22.18)	75.44 (27.71)	78.02 (19.93)	71.67 (22.01)	70.03 (22.71)
Asthma	75.72 (20.02)	65.91 (21.32)	71.76 (17.84)	77.42 (23.87)	77.86 (20.39)	73.59 (19.46)	68.49 (20.96)
Cancer	77.66 (17.87)	56.61 (23.33)	73.85 (18.08)	80.09 (22.35)	79.04 (19.00)	72.43 (19.18)	72.80 (20.25)
Depression	68.35 (21.38)	61.15 (22.92)	60.96 (24.26)	66.15 (29.16)	71.97 (21.96)	63.07 (23.83)	61.28 (24.95)
Diabetes	73.55 (19.47)	61.05 (20.21)	69.65 (21.42)	75.82 (24.84)	73.64 (21.21)	69.59 (20.30)	66.59 (22.12)
Hypertension	80.24 (15.92)	71.88 (17.50)	74.98 (18.85)	81.54 (21.52)	79.01 (18.24)	74.67 (19.96)	74.23 (19.47)
Heart	78.18 (17.77)	62.00 (21.53)	72.26 (20.31)	81.23 (21.66)	78.67 (17.89)	72.10 (19.31)	71.18 (20.34)
Other	75.43 (18.46)	61.32 (22.65)	69.40 (21.59)	77.88 (23.41)	77.67 (19.63)	70.01 (21.33)	69.66 (21.41)

A MANOVA revealed a statistically significant difference F (7, 3241)=7544.45, p=.00; Pillai's Trace =.94; partial-eta squared =.94.

Post-hoc procedures (Games-Howell) were then conducted to detect specific differences in domain scores between diabetes and each of the other medical conditions. These differences are reported in Table 7 with significant results indicated by asterisks.

Table 7

Difference in Mean Domain Scores between the other Medical Conditions and Diabetes

	Mean Domain Scores $_{Other}$ minus Mean Domain Scores $_{Diabetes}$						
Medical Condition	Standard Of Living	Health	Achievements	Personal Relationships	Safety	Community Connectedness	Future Security
Anxiety	-4.03	.89	-3.10	-8.07	-3.80	-4.60	-3.69
Arthritis	1.64	-3.78	2.58	-.38	4.39	2.08	3.44
Asthma	2.18	4.87	4.63	1.60	4.23	-3.00	1.90
Cancer	4.12	-4.44	6.72	4.27	5.40	2.84	6.21
Depression	-5.20	.10	-6.17	-9.67*	-1.66	-6.52	-5.31
Hypertension	6.69**	10.84**	7.85**	5.72	5.38	5.08	7.64**
Heart	4.63	.96	5.12	5.41	5.03	2.51	4.59
Other	1.88	.28	2.51	2.06	4.04	.42	3.07

*p<.01, **p<.001

Previous analyses comparing mean PWI scores between diabetes and the other medical conditions detected a significant difference in scores between hypertension and heart disease (higher than diabetes) and depression (lower than diabetes). Upon examining the domains, it appears that people with hypertension are more satisfied with their standard of living, their health, achievements and future security compared to those with diabetes.

Whilst the PWI for people with diabetes is significantly lower than for those with heart disease, no significance differences in mean domain scores are apparent between these two conditions. Perhaps the significant difference in wellbeing between those with diabetes and heart disease is due to accumulative differences in domain scores rather than differences in specific domain(s).

Finally, people with diabetes had a higher PWI compared to people with depression. However, when examining the domains, the only difference is in the domain of relationships, which is significantly higher for people with diabetes.

CHAPTER 5

DISCUSSION FOR STUDY ONE

This study compares the wellbeing of Australian adults with a chronic illness to their healthy counterparts using data from the Australian Unity Wellbeing Index. The study also assesses whether low scores on the health domain for people with a chronic illness are compensated by higher scores on other domains and compares the SWB of people with diabetes to those with other medical conditions.

Overall Wellbeing and Domain Scores

The results demonstrate that people with a chronic illness experience lower levels of wellbeing than people from the general population who are not living with a medical condition. Having a chronic illness also reduces wellbeing below the lower level of the normative range for the Australian population. In an attempt to understand the reasons for this, factors known to influence SWB such as age, relationship status, income and unemployment, were also examined.

People with a chronic illness are older, more likely to be living without an intimate partner, earning a lower income, and more likely to be unemployed compared to those without a medical condition. Apart from age, these demographic variables significantly disadvantage people in the happiness stakes (Argyle, 1999). However in this study, the difference in SWB remained, even after controlling for the above variables. Therefore, all things being equal, experiencing a chronic illness is a significant stressor and thereby challenges SWB homeostasis. This finding is consistent with previous research (McCabe, 2002; Mehnert, 1990; Verbrugge, 1994)

Furthermore, people with a chronic illness experience less satisfaction with their life domains except for community connectedness. As expected, the biggest difference occurs in the health domain where a gap of 17.2 percentage points separated those with a medical condition from those without. The study

also provides evidence for the operation of the homeostatic mechanism of domain compensation. Whilst satisfaction with health is considerably lower in people with a chronic illness, the contribution of five other domains, namely, standard of living, relationships, safety, community connectedness, and future security, to the PWI was correspondingly increased, relative to those without a medical condition. The domain of community connectedness compensated more than the other domains. It is therefore possible that dissatisfaction with health motivated participants with a chronic illness to redress the imbalance by having a greater appreciation for other aspects of their lives, and in particular the connection with their community. The presence of this compensatory mechanism on life satisfaction supports the theory of SWB homeostasis and validates the findings of Best and colleagues (2000).

The domain of achieving in life also deserves special comment. It has been suggested that having valued personal goals is important for wellbeing Gollwitzer & Moskowitz, 2007; Schmuck & Sheldon, 2001). It is interesting that in the present study, apart from health, the domain of achieving in life is the only other domain where the mean score is below the normative range for the Australian population. One explanation could be that having a medical condition redirects finite internal and external resources, away from personal goals and towards more health-related goals. This finding supports Diener's claim that ill-health can interfere with achieving goals (Diener, 1999) and lower satisfaction with this domain along with health, feature most strongly in lowered SWB for the group with a medical condition.

Specific Medical Conditions

When the eight specific medical conditions are considered separately, it is apparent that not all impact SWB in the same way. Diabetes, depression and anxiety appear to be stronger and more negative challenges than the other conditions, because SWB for people with these conditions falls below the threshold of 70 points. The SWB scores for people with diabetes are congruent with epidemiological evidence for the high prevalence of depression in people with diabetes (Anderson et al. 2001). As mentioned previously, for a group mean to fall below the lower threshold of 70 percentage points, it means that a

larger proportion of people than normal are likely to be experiencing depression (Davern, 2004). Additional evidence that depression might be a feature of people with diabetes is the observation, in this study, that diabetes and depression share a similar profile in regards to their domains. Apart from the Relationships domain, there are no significant differences on any of the other domains between these two groups.

This result is different from the findings of an Australian population study in which asthma was found to have a more negative impact on life satisfaction than diabetes (Ampon et al. 2005). However, because the authors of this study report their results as rate ratios, it is not possible to standardise the scores and directly compare the findings from the two studies.

The present findings also differ from the results of the British Columbian study by Grigg and colleagues (2006). These authors found no difference in life satisfaction between people with diabetes and the rest of the community. However, as mentioned previously, the small sample in this study and the methodological anomalies, may have limited the power to detect any differences in wellbeing. So, in regards to the differences between the present research and the above two studies, it is difficult to know whether the results are really different or whether results are confounded by the measures used and the study designs.

Whilst many of the chronic conditions studied were associated with reduced wellbeing scores, it is interesting that no such association was found with hypertension. The mean SWB for this group is actually higher than the upper range for the general population. This finding reinforces understanding that objective health does not necessarily influence judgments pertaining to the quality of one's life. Objectively, people with hypertension have an increased risk of heart attack and stroke. Yet subjectively, their pathology appears to have little impact on their wellbeing scores. This may be because their prescribed medication successfully controls their condition and medicine compliance is less of a burden compared to say blood glucose monitoring, and dietary adherence necessary to manage diabetes.

Limitations

One of the limitations in this study is the lack of contextual information related to the specific conditions. The presence of co-morbidities significantly and negatively influences wellbeing (Mehnert et al. 1990; Verbrugge, Reoma, & Gruber-Baldini, 1994) but in the present study, participants were only able to report one condition, the one of most concern. In reality some conditions are unlikely to occur in isolation. For example, people with diabetes are more likely to have concurrent medical conditions such as heart disease and hypertension, compared to those with arthritis or asthma. Therefore, while the differences in wellbeing between the different medical conditions may have been influenced by the presence of co-morbidities, this influence remains unknown.

Recommendations

It would be advantageous for medical researchers to routinely measure SWB. They could then ascertain the impact of ill health and its management on the patient's quality of life and a valid comparison with people not experiencing chronic illness could be made.

Future research is needed to explore the impact of a chronic illness on wellbeing over time, and this is the purpose of Study Two. It uses a longitudinal design and will examine how Type 1 diabetes impacts on wellbeing over time.

CHAPTER 6

INTRODUCTION TO STUDY TWO

Intensive Insulin Treatment

Diabetes Control and Complications Trial

In 1993 researchers involved in the landmark study, the Diabetes Control and Complications Trial (DCCT), stated unequivocally that reducing HbA_{1c} with intensive insulin treatment delayed the onset and progression of microvascular diabetes complications (DCCT Study Group, 1993). Since this study, intensive treatment has now become standard practice for the management of Type 1 diabetes. This involves either delivering insulin via a continuous subcutaneous infusion or more commonly, a basal-bolus insulin regimen. The latter method involves injecting boluses of short-acting insulin before meals, and long-acting insulin at bedtime and/or at breakfast to maintain a background or basal level of insulin in the blood stream.

Whilst the DCCT provided a breakthrough in understanding how best to clinically manage diabetes, fifteen years later, 25-50% of patients are unable to achieve the glycaemic targets of < 7% (DeVries, Snoek, & Heine, 2004; Resnick, Foster, Bardsley, & Ratner, 2006; Säaddine et al. 2006). In Australia, the biennial audit of Australian diabetes centres has revealed similar percentages of people with poor metabolic control (Flack & Colagiuri, 2006).

Barriers to Intensive Treatment

There are many reasons why good diabetes control remains an elusive goal. For instance, an unwelcome by-product of lower blood glucose levels is the increase in hypoglycaemic episodes. Patients in the intensively managed group of the DCCT, had a three-fold increase in such episodes compared to those in the control group (DCCT Study, 1993). Therefore, for some people, the ‘cost’ of good control is too great and they would rather maintain elevated blood glucose levels, thereby avoiding hypoglycaemia (Jacqueminet, Masseboeuf, Rolland, Grimaldi, & Sachon, 2005). In approximately 5% of

people, avoidance of ‘hypos’ is extreme, meeting the criteria for a phobia with this behaviour more likely in those experiencing anxiety (Jacqueminet et al.).

Other psychological co-morbidities such as depression (Jacobson, de Groot, & Samson, 1997), described in the main introduction, as well as eating disorders are thought to contribute to the failure to achieve optimum targets (Rydall, Gary, Rodin, Olmsted, Devenyi, & Daneman, 1997). It is believed that preoccupation with food is partly responsible for the increase in both clinical and sub-clinical eating disorders amongst females with Type 1 diabetes (Steel, 1996). Underpinning this increased prevalence is the unique purging mechanism available to people with Type 1 diabetes, whereby the impact of over-eating on weight gain can be negated by omitting or reducing insulin, resulting in excess calories that would normally contribute to energy intake being excreted in the urine. Finally, another factor that further reduces the desirability of good metabolic control is that higher doses of insulin, often required to achieve improved glycaemia, are associated with weight gain. Indeed, participants in the intervention arm of the DCCT were 33% more likely to become overweight (DCCT Study Group, 1993).

Flexible Approaches to Insulin Delivery

What is Dose Adjustment For Normal Eating?

Compared to insulin treatment prescribed in the DCCT, the programme Dose Adjustment For Normal Eating (DAFNE), offers a more flexible approach to diabetes management. The DAFNE programme was developed in the United Kingdom and adapted from the German Diabetes Treatment and Training Program. Similar to the German programme, the adapted programme is patient-centred, skills-based, and involves collaboration with health professionals (a diabetes nurse educator and dietician) throughout the 5 consecutive days of the program. It differs from methods used in the DCCT by offering a titrated insulin dose to the desired carbohydrate intake rather than adapting one’s lifestyle to prescribed doses of insulin.

The programme is highly experiential in that participants personalise the information to their particular situation and there are many opportunities to

practise the skills in a supported environment. The participant is actively involved in calculating the amount of carbohydrate they are going to eat and estimating an appropriate dose of insulin. This model is different from those advocated in many other diabetes education programmes where patients are often passive recipients of the learning (Skinner, Cradock, Arundel, & Graham, 2003). As the 5-day DAFNE programme progresses, participants gain confidence in their ability to make decisions that improve their day-to-day blood glucose excursions. The programme has an "off-the-shelf" curriculum with quality assurance processes in place to ensure it is delivered in a standardised and coordinated way. At this point there is not standard system for following up those who have completed the DAFNE training. Some centres organise 3-monthly follow-up for their graduates and others do not have such mechanisms in place. In the DAFNE study it is not possible to differentiate between those DAFNE graduates who do or do not receive any follow-up.

Furthermore, currently the programme does not include a psychosocial component; this is not surprising given DAFNE is primarily designed to improve metabolic control rather than psychological health. However, even without a mental health focus, it is plausible that DAFNE could positively influence psychological health, because of the programme's emphasis on mastery, patient-centredness, and the development amongst participants of a sense of affiliation with other people with Type 1 diabetes. These factors reflect relatedness, competence, and autonomy, the three human needs identified as being important for wellbeing (Deci, 1992; Vansteenkiste, Ryan, & Deci, 2008). Furthermore, for people with diabetes, social support (relatedness) has also been identified as an important factor in ameliorating depression (Penninx, van Tilburg, Boeke, Deeg, Kriegsman, van Eijk, 1998). Given the high prevalence of mental health problems in people with diabetes, and the dearth of psychologists in diabetes care teams, it is important to identify whether programmes intended to improve physical health can also provide benefits to psychological health. Currently there is only limited evidence that DAFNE may be one such programme.

The Benefits of a Flexible Approach for Physical Health

Over the past decade a considerable body of evidence has been accumulated demonstrating that the German programme consistently improves HbA_{1c} levels without an increase in hypoglycaemic episodes. A study of 1,103 individuals from 57 institutions in Germany, who had all participated in the programme, were followed up for 12-15-months (Müller et al. 1999). The authors showed that HbA_{1c} levels, incidence of severe hypoglycaemia, and diabetic ketoacidosis, all reduced significantly. Also, hospitalisations reduced from 7.27 days to 4.26 days per year. This reduction was sufficient to demonstrate cost-effectiveness of the programme.

A longer follow-up study of three-years, involving 201 patients, again demonstrated significant benefits to HbA_{1c} and the incidence of severe hypoglycaemia (Pieber, Brunner, Schnedl, Schattenberg, Kaufman, & Krejs, 1995). However, beyond three-years, the evidence for the programme being associated with better diabetes control appears to be equivocal. A study by Plank and colleagues (2004) was not able to show sustained changes in HbA_{1c} levels at their six and twelve-year follow-ups, although the benefits in relation to reduced hypoglycaemic episodes were still evident. On the other hand, a Russian study was able to show that after 13-years, patients in the intervention group who had completed the German programme and were followed-up every 4 to 6-months, sustained the gains in their HbA_{1c} levels compared to the control group (Dvoynishnikova, Mayorov, Galstyan, Antsiferov, & Dedov, 2004). However two points are noteworthy, the first is that in the control group were participants who had also completed the Diabetes Treatment and Training programme but received less frequent follow-up by providers who were not working in a diabetes-care agency. It would therefore appear that the benefits of the programme are weakened when follow-up care is provided by professionals with limited expertise. Secondly, the baseline HbA_{1c} levels were much higher than those in Plank and colleagues' (2004) study (9.5% versus 7.9%). The Russian study therefore afforded a greater opportunity to improve diabetes control with the initial levels being so elevated.

The most recent outcome data from patients completing the German programme, supports previous findings of improved diabetes control without a concomitant increase in hypoglycaemic episodes (Sämaan, Mühlhauser, Bender, Kloos, & Müller, 2005). In this large study, over 9,500 patients were examined during a 12-year period. Every three years, 50 consecutive patients from 96 diabetes clinics were reexamined, one year after completion of the programme. Whilst the large sample size is impressive, the study does not have a control group and individual patients have not been followed up for more than 1-year.

The above studies have primarily focused on clinical outcomes without considering psychosocial variables such as quality of life. One early study, not yet mentioned, examined psychosocial variables but, the authors were interested in whether these variables could predict glycaemic control rather than whether they changed after participation in the programme (Bott, Jörgens, Grüsser, Bender, Mühlhauser, & Berger, 1994). The results of this study showed that perceived coping abilities, affiliation with a self-help group and follow-up at a diabetes outpatient clinic, predicted better HbA_{1c} results, whilst being female was associated with higher HbA_{1c} values. The study therefore contributes to the knowledge base regarding psychosocial correlates of HbA_{1c} levels, but does not enhance understanding about the psychosocial impact of a programme offering a flexible approach to insulin delivery.

Psychological Benefits from Flexible Insulin Delivery

Fortunately, when DAFNE was being developed, clinicians were interested in its psychological impact. As a result of this interest, the DAFNE study group included quality of life and wellbeing as outcome measures in their randomised controlled trial (DAFNE Study Group, 2002). One hundred and sixty-nine patients were randomised into immediate DAFNE (N = 84) or delayed DAFNE (N = 85) where participants commenced the programme six months after being assessed. The clinical results of the trial were congruent with research into the Diabetes Treatment and Training Programme, showing reductions in HbA_{1c} of one per-cent, 6- months post-training. Whilst this improvement had reduced by 0.5% at 12-months, it remained significant from

baseline. As expected, the improvement in diabetes control was not associated with an increase in severe hypoglycaemia.

Importantly, using the audit of diabetes-dependent quality of life (ADDQoL) questionnaire to measure quality of life (Bradley, Todd, Gorton, Symonds, Martin, & Plowright, 1999) and the 12-item Wellbeing Questionnaire (W-BQ12) to measure psychological wellbeing (Bradley, 1994; Bradley & Lewis, 1990) the authors were able to demonstrate improvements in these two psychological outcomes. For many health professionals this result was a counter-intuitive finding as many predicted that the increased blood glucose monitoring, and extra insulin injections associated with DAFNE, would negatively impact on quality of life (Bradley, 2002).

However, this exciting finding is limited by the measures used in the DAFNE study trial. The stem question of the ADDQol asks, "If I did not have diabetes…" This stem creates a series of questions framed negatively, and because of this, the questions are more challenging cognitively to answer (Polonsky, 2000) thereby weakening the reliability of the scale. The domains of the ADDQoL are also problematic. Some of them are generic e.g. personal relationships, current achievements, and health, whilst others such as the "degree of freedom to eat as I wish", "ease of travelling", and "the way society reacts to me", are more specifically related to living with diabetes (Bradley et al. 1999). These diabetes-specific domains could be described as causal variables in that their impact on QOL is likely to be uni-directional. For instance, not being free to eat what you want may negatively impact your QOL, but being able to eat freely does not mean you are living a life of quality. For this reason, Fayers and colleagues (1997) believe that "individual causal indicators clearly fail as a measure of good QOL" (p. 403). Yet the authors of the ADDQoL believe that because restrictions on dietary freedom have a negative impact on the lives of people living with diabetes, "treatments that increase dietary freedom without loss of metabolic control will improve quality of life for many patients" (Bradley & Speight, 2002, p. S69). This claim therefore defines a life of quality for someone with diabetes, as one where diabetes is having less impact, rather than satisfaction with life in

general and a positive state of being (Cummins, Eckersley, Pallant, et al. 2003).

The weighted scores used in the ADDQoL, derived by multiplying the rating of a life domain by its importance to the respondent are an additional cause for concern. There is evidence suggesting that not only is there little advantage in weighted scales but the measurement properties of these scales can make them difficult to interpret (Trauer & McKinnon, 2001). Furthermore because the importance ratings contribute little in predicting global wellbeing, for the sake of parsimony, these authors advise against the practice (Trauer & McKinnon).

The other questionnaire used in the DAFNE trial, the 12-item wellbeing questionnaire, was reviewed by Pouwer and colleagues (2000) who identified three factors; positive wellbeing, negative wellbeing and energy. However, as there is currently no evidence to suggest the W-BQ12 has the sensitivity or specificity to detect depression and anxiety (Pouwer, Van der Ploeg, Ader, Heine, & Snoek, 1999), this study does not tell us if the DAFNE training had an impact on the two most reported psychological co-morbidities associated with diabetes.

To the chagrin of health psychologists, there is currently minimal evidence in the diabetes literature demonstrating the existence of interventions that bridge the mind-body dichotomy, meaning interventions that are not only good for the body but also good for the mind. Petrak (2008) uses the term ‘two-in-one treatment’ to describe these elusive interventions, and whilst DAFNE offers the possibility of being such an intervention, more compelling evidence is required.

OZ DAFNE

In November 2004, clinicians representing three Australian states, observed a DAFNE programme in the United Kingdom (UK), and undertook training in the educational strategies used to deliver the programme (McIntyre, 2006). Upon their return home, the UK course materials were adapted to the Australian health-care context, and an OZ DAFNE collaborative established

with strong links to the UK. This collaboration remains in place to this day, and is an important initiative to ensure consistent standards in training resources, and the way in which the programme is delivered, are maintained. This standardised approach facilitates research into the programme as it reduces confounding variables such as different content, participant materials, etc.

In 2005 the first OZ DAFNE programmes were delivered, receiving positive client feedback (McIntyre, 2006). However, many more diabetes centres are required to offer DAFNE if the programme is to become widely available to people with Type 1 diabetes. Disseminating DAFNE will not happen unless clinicians, and more importantly those responsible for funding, are assured the programme has a credible evidence base.

Why study OZ DAFNE?

The DAFNE programme in Australia is new, and as such, has not been investigated using a controlled trial design. This study will be the first to do so, and will provide information about the impact of participating in a DAFNE programme for Australian adults with Type 1 diabetes.

The approach used to measure psychological constructs in this study is different from that used in the UK DAFNE trial. Rather than using the ADDQoL to measure quality of life, the present study will use the Personal Wellbeing Index (PWI) (Cummins, 2003). This scale differs from the ADDQol in that it uses domains described as effect-indicator rather than causal variables (International Wellbeing Group, 2006). Effect indicator variables correlate with each other and have a greater correlation coefficient with global QOL (Fayers, Hand, Bjordal, & Gorenvold, 1997). Therefore, changes in the domains of the PWI, are more likely to reflect substantive changes from participation in DAFNE on global QOL, compared to that provided by the UK trial.

Additionally, in this study, the psychological correlates of wellbeing, namely, self-esteem, optimism, control and self-efficacy will be examined to assess if participation in DAFNE is associated with any changes to these

variables. Finally, specific attention will be paid to the affective disorders of depression and anxiety. Neither the British nor European studies have investigated whether a flexible approach to insulin delivery can reduce anxiety and depression, and it is difficult to anticipate whether such an approach will in fact influence these disorders. On the one hand, the possible fulfilment of the psychological needs already mentioned, may improve participants' mental health. However, on the other hand, DAFNE is not designed to treat anxiety and depression, and this lack of specificity may limit the capacity of the programme to achieve broader mental health outcomes (Bennett, 2004).

Therefore, in this study, it is proposed that 12-months after completion of the DAFNE programme, and compared to a control group who are engaged in usual care;

1. Participants in the DAFNE group will have higher wellbeing scores.

2. Adults with threatened SWB homeostasis, demonstrated by a wellbeing score below the threshold of 70 percentage points, will achieve greater increments to their wellbeing, compared to those above the threshold.

3. Adults with high scores on anxiety and depression, will demonstrate a reduction in these scores.

CHAPTER 7

METHOD FOR STUDY TWO

This study is a multi-centre study involving three Australian states, the purpose of which is to investigate the psychological impact of DAFNE training in adults with Type 1 diabetes. Each local ethics committee of the 7 participating centres approved the study.

Participants

Recruitment: Intervention Group

Participants in the intervention group were recruited from the following regional and metropolitan diabetes centres:

Victoria

- Diabetes Australia-Victoria

  Melbourne

  Geelong

- Royal Victorian Eye and Ear Hospital

- North-East Health Wangaratta

Queensland

- Mater Adult Hospital

- Gold Coast Hospital

- Cairns Diabetes Centre

South Australia

- South East Regional Community Health Service

Each diabetes centre advised their clients of the dates for their forthcoming DAFNE programmes. Prior to participation in the programme, all prospective DAFNE trainees routinely attend a pre-DAFNE assessment. This appointment enables the diabetes nurse educator to review the client's insulin regimen, frequency of hypoglycaemic episodes and general diabetes management. Some clients will want to participate in DAFNE training because they are unable to achieve the recommended HbA_{1c} targets while others may have good glycaemic control but are bothered by frequent hypoglycaemic episodes and possibly an absence of hypoglycaemic symptoms. Recruitment to the DAFNE study occurred during this assessment. A plain language statement was available and those interested signed a consent form at that time (Appendix A). Clinical information recorded on the pre-DAFNE assessment form (Appendix B) provided baseline data.

To be eligible for inclusion in the study participants were:

- Aged ≥ 18-years
- Diagnosed with Type 1 diabetes for one-year or more
- Treated with a basal-bolus insulin regimen
- Willing to complete the 5-day DAFNE training

Prospective DAFNE participants were ineligible to be part of the research if they were pregnant at the outset or became pregnant during the 12-months of the study. This exclusion is because the efficacy of the DAFNE programme has not been tested with pregnant women. Participants were also excluded if a subcutaneous infusion (pump) was used to deliver the insulin. When using a pump, it is not necessary to use long-acting insulin, and as the DAFNE protocol has been developed for people using a basal-bolus insulin regime, it was believed important to maintain the homogeneity of the research sample with regards to their method of insulin delivery.

Note: (After participating in a DAFNE programme, participants returned to their usual clinic for follow-up care. However, as mentioned

previously, whilst some DAFNE centres offer reunions for their DAFNE graduates at various time intervals, these meetings have never replaced routine medical follow-up.)

Recruitment: Control Group

The control group were adults with Type 1 diabetes, recruited from Diabetes Australia-Victoria's membership database. A single invitation letter was posted to 4,100 members to participate in the research project. The mail-out included the plain language statement (Appendix C), a questionnaire related to diabetes (Appendix D), and a questionnaire related to the psychological variables and demographic information (Appendix E). Completion and return of the questionnaires were interpreted as consent to participate.

The inclusion criteria were similar to the intervention group. Any adult with Type 1 diabetes was eligible to participate provided they were not using a pump to deliver their insulin. Pregnant women were not excluded but their data were not used for the analyses to follow. If participants in the control group had already attended a DAFNE programme, then they were ineligible to be part of the present study.

Design

A repeated-measures, controlled trial design was used. It was not possible to randomise participants to the intervention or comparison groups because for most centres the period during which the study was conducted was the first time they had offered the programme. The DAFNE facilitators were therefore unwilling to disappoint participants by excluding them from the intervention group.

In the study the independent variable was participation in a DAFNE programme and dependent variables included;

- Subjective Wellbeing
- Core Affect

- Self-Esteem
- Self-Efficacy
- Diabetes-Related Distress
- Anxiety
- Depression
- Optimism
- HbA_{1c}

Demographic data were collected at baseline for all research participants. Whilst the study has a psychological focus, information relating to physical health that could potentially impact on blood glucose control and/or the mental state of the participants was also collected. This information included weight, height, and the presence of diabetes complications (Appendix D).

Materials

Factor analyses, assessing the reliability of all the psychological questionnaires in the study, were conducted and the results are reported in the results section.

Subjective Wellbeing (SWB)

The Personal Wellbeing Index was used to measure SWB (Cummins et al. 2003) and has been described in the Method section of Study 1.

Core Affect

Core affect was measured with three items that have been assessed by researchers to best reflect the object free, neuropsychological state of core affect (Davern, Cummins, & Stokes, 2007). These three items assess hedonic tone and activation.

Self-Esteem

The Rosenberg Self-Esteem Scale (Rosenberg, Schooler, & Schoenbach, 1989) was used to measure self-esteem. This comprises 10-items that measure global self-esteem. The Rosenberg Self-Esteem Scale has been used widely and is positively related to most measures of psychological wellbeing and negatively correlated with anxiety and depression (Rosenberg, Schoenbach, Schooler, & Rosenberg, 1995).

Self-Efficacy & Control

Self-efficacy and control were measured with a tool specifically developed for this study. The 8-item measure is specific to the behaviours and beliefs most likely to be associated with completing a DAFNE programme.

Self-efficacy refers to a perceived ability to execute a particular course of action (Kanfer & Zeuss, 1983) and primary control involves reducing the disparity between what one wants for their diabetes and the individual's real-life situation (Rothbaum, Weisz, & Snyder, 1982).

Three of the items relate to self-efficacy, and five to primary control over diabetes.

Diabetes-related Distress

The Problem Areas In Diabetes (PAID) is a 20-item single-factor questionnaire that measures diabetes-related distress (Polonsky, Anderson, Lohrer, et al. 1995). The PAID has demonstrated discriminant validity by detecting differences in the emotional impact of Type 1 compared with Type 2 diabetes (Welch, Jacobson, & Polonsky, 1997). The scale has been primarily validated with people using insulin (Watkins & Connell, 2004), and has been used to assess the effectiveness of diabetes interventions (Welch, Weinger, Anderson, et al. 2003).

Anxiety and Depression

Anxiety and depression were measured using the Hospital, Anxiety, and Depression Scale (HADS) (Snaith, 2003). This scale is a 14-item

questionnaire with seven questions relating to the two subscales of anxiety and depression. Each response is scored from 0-3. The anxiety and depression scores are categorized as normal (0-7), mild (8-10), moderate (11-14), and severe (15-21). The scale has been validated in many studies and has been deemed appropriate for use in community and primary care settings (Snaith, 2003).

Optimism

Optimism was measured using the three positive questions from the LOT-R (Life Orientation Test-Revised) (Scheier, Carver, & Bridges, 1994).

Glycosylated Heamoglobin (HbA_{1c})

This test is a measure of diabetes control and involves a laboratory examination of a blood sample. The underlying principle is that in the normal 120-day life span of the red blood cell, glucose molecules attach to the haemoglobin, forming glycosylated haemoglobin (Peragallo-Dittko, Godley, & Meyer, 1994). Individuals with poorly controlled diabetes have increased quantities of these haemoglobins.

Once a haemoglobin molecule is glycosylated, it remains that way (Peragallo-Dittko, Godley, & Meyer, 1994). Therefore, a build-up of glycosylated haemoglobin within the red cell reflects the average level of glucose to which the cell has been exposed during its life-cycle. The HbA_{1c} level is proportional to average blood glucose concentration over the previous four weeks to three months and provides a measure of the effectiveness of diabetes treatment (American Diabetes Association, 2007). The Association recommends an HbA_{1c} level of < 7% for most people with diabetes (American Diabetes Association).

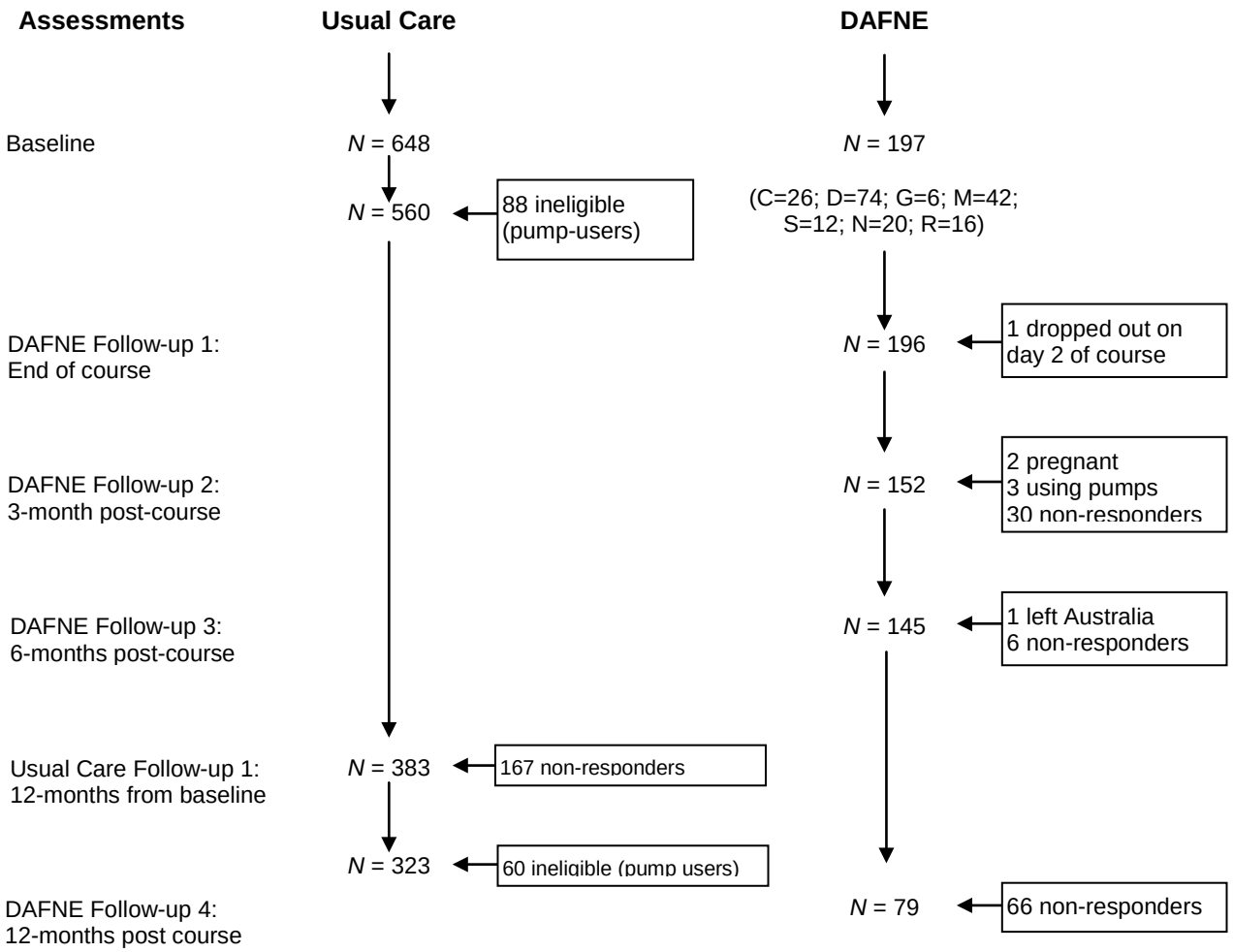
The HbA_{1c} data for the control group at baseline and 12-months were self-reported and their accuracy was unable to be checked. The DAFNE group presented their laboratory results to their diabetes educator at baseline and 12-months, however at the 6-month data collection point, HbA_{1c} results were self-reported and not verified by a health professional.

CHAPTER 8

RESULTS FOR STUDY TWO

Results of Recruitment

From the 4,100 letters sent to people with Type 1 diabetes, 648 people agreed to participate in the study (16%) forming the control group. Of these, 88 were pump users, and were therefore excluded. For the intervention group, 196 DAFNE participants were recruited from a possible 215 (91%). Response rates for the individual DAFNE centres is not known. Figure 3 below shows the flow of participants through the study.



Abbreviations: (C=Cairns Diabetes Centre; D=Diabetes Australia-Victoria; G=Gold Coast; M=Mater Adult Hospital; S=South-East Community Health Service; N=North-East Health Wangaratta; R=Royal Victorian Eye & Ear Hospital; W=Wangaratta

Figure 3. Flow of participants through the study.

As Figure 3 shows, the drop-out rate increased over the duration of the study with approximately 60% of usual care participants responding to the questionnaires at 12-months and 40% of DAFNE participants. Thus, the final samples at 12-months comprised 79 people in the DAFNE group and 323 in the comparison group.

Preparation of the Baseline Data

Prior to statistical analyses, the data were examined through SPSS Version 15.0 for accuracy of data entry, and missing values. Scores for categorical and continuous variables all fell within the possible range. The data for each dependent variable were screened by group. The distributions of the continuous variables were checked for skewness and kurtosis, and analysed for normality (Kolmogorov-Smirnov). An examination of the skewness and kurtosis statistics indicated that all the continuous variables, with the exception of self-efficacy for the intervention group, were not normally distributed. The greatest skew and kurtosis occurred for the HbA_{1c} variable in the DAFNE group, being 1.12 and 3.54 respectively. Whilst these levels may be a concern for parametric analyses, it was decided to wait until outliers had been recoded before a decision regarding transformations of the data was made.

Univariate outliers were recoded by assigning a raw score one unit larger than the next most extreme score in the distribution (Tabachnick & Fidell, 2001). For the PWI, 16 outliers for the usual care group were recoded and 11 for the DAFNE group. In core affect, 16 outliers were detected in the usual care group and recoded, and 12 in the DAFNE group. In the data for self-esteem, no univariate outliers were detected. Self-efficacy had 5 and 12 outliers for the usual care and DAFNE groups respectively. In the PAID data, 5 outliers were recoded for the usual care group only. The depression variable required 13 and 14 outliers to be recoded for the usual care and DAFNE groups respectively. In the anxiety variable, 8 outliers were recoded for the usual care group and 10 for the DAFNE group. Twelve outliers for optimism were recoded in the usual care group and 7 for the DAFNE group.

Glycosylated Haemoglobin data for the intervention and usual care groups had 13 and 17 univariate outliers respectively that required recoding.

Upon re-examination of the distributions of the above variables, skewness and kurtosis were improved with the highest skewness found for depression in the DAFNE group (.93) and the PAID variable demonstrating the highest kurtosis value at .87, again for the DAFNE group. In smaller samples ($N < 200$) it is recommended that values for skewness and kurtosis be converted to *z*-scores. These *z*-scores can then be compared against known values for a normal distribution that would be expected by chance alone (Field, 2005). However because of the small standard error in large samples, significant values for the *z*-scores will arise from even small deviations from normality (Field). Therefore for large samples it is appropriate not to apply a criterion for ascertaining if values for skewness and kurtosis are a concern, but instead to "look at the shape of the distribution visually, and the value of the skewness and kurtosis statistics rather than calculate their significance" (Field). Further advice was provided by Curran et al, who after extensive Monte Carlo testing of the effects of non-normal distributions identified that univariate skewness ≥ 2.0 and kurtosis ≥ 7.0 were more likely to distort results (Curran, West, & Finch, 1996). Therefore, as mentioned above, given the highest levels for skewness and kurtosis in the samples are .93 and .87 respectively, it was decided that this degree of skewness and kurtosis is unlikely to make a difference to the analyses, and transformations were not undertaken. Furthermore, as in Study One, the skewness is likely to be meaningful to the data and multivariate analysis is robust to mild violations of normality (Tabachnick & Fidell, 2001).

Examination of the scatterplots revealed the data generally met the assumption of linearity. Mahalanbois distance was used to check for multivariate outliers using a cut-off criterion of $p < .001$. The Mahalanbois distance value of 55.97 is greater than the critical value of 27.88 for nine dependent variables, indicating the presence of multivariate outliers. Seven cases exceeding the critical value in the usual care group were identified and no cases in the DAFNE group. After deleting the seven cases, Mahalanbois

distance value was found to be a more acceptable 29.27. Whilst it is still marginally higher than the critical value of 27.88, MANOVA can tolerate a few outliers with a reasonably sized data file, and particularly if the scores are not extreme (Pallant, 2005).

Missing values were detected for a number of variables. In a large data set, ≤ 5% of missing data points in a random pattern, are less serious (Tabachnick & Fidell, 2001). In the present data set, no patterns were detected for missing data and so missing values were managed by excluding cases only as required for the specific analysis. It is important to note that the usual care group had 18.6% of values for HbA_{1c} missing compared to the 5.6% in the DAFNE group. It is to be expected that the DAFNE group would have fewer missing values on this variable as having a laboratory blood test is a requirement prior to participation in a DAFNE programme. Given the discrepancies in missing HbA_{1c} values, it will therefore be prudent to interpret any differences in HbA_{1c} with caution.

All the variables related to positive affect such as PWI, core affect, self-esteem, self-efficacy, and optimism were converted to a Percentage of Score Maximum reported in the Method section of Study One. The variables of depression, and anxiety were scored according to standard procedures. The maximum score for depression and anxiety is 21, with a score > 7 categorised as above normal.

Factor Analyses

The seven scales used in the study were subjected to factor analyses and assessment of internal consistency to ensure they were performing as intended with the present sample. The scales analysed were;

- Personal Wellbeing Index (PWI)
- Core Affect
- Rosenberg's Self-Esteem Scale
- Self-efficacy

- Problem Areas in Diabetes (PAID)
- Hospital Anxiety and Depression Scale (HADS)
- Life Orientation Test – Revised

Initial factor analyses extracting eigenvalues over the value of one were performed on both the original and recoded data. No substantial differences were found between the two solutions, so it was decided to use the original data for the analyses. Similarly, initial factor analyses extracting eigenvalues over the value of one were performed on each of the samples. No substantial differences were found between the usual care and DAFNE groups, deeming the combined sample appropriate for the analyses.

Prior to performing principal components analysis (PCA) the suitability of the data for factor analyses was assessed. Inspection of the correlation matrices for all the scales revealed all coefficients were above .3 with the exception of the HADS scale. However, a substantial majority were above .3 in this scale. The Kaiser-Myer-Olkin measures of sampling adequacy for each item of the scales was between .7 and 1, boding well for factor analyses to yield distinct and reliable factors (Field, 2005). All scale matrices were factorable as indicated by significant results for Bartlett's tests of sphericity.

Personal Wellbeing Index (PWI)

The PWI scale used in this study contains seven items, each item measuring satisfaction with a particular life domain. Together, these items represent the construct Subjective Wellbeing. Principal components analysis of the PWI revealed the presence of one factor with an eigenvalue exceeding 1, explaining 66.93 per cent of the variance. An inspection of the scree plot revealed a clear break after the first factor. An additional technique, parallel analysis was also conducted. This technique involves "…comparing the size of the eigenvalues with those obtained from a randomly generated data set of the same size. Only those eigenvalues that exceed the corresponding values

from the random data set are retained." (Pallant, 2005, p. 175). Results of this procedure are shown in Table 8.

Table 8

Comparison of Eigenvalues from PCA of the PWI and the Corresponding Criterion Values obtained from Parallel Analysis

Factor Number	Actual Eigenvalue from PCA	Criterion Value from Parallel Analysis	Decision
1	4.69	1.14	Accept
2	.56	1.09	Reject
3	.49	1.04	Reject
4	.37	.10	Reject
5	.36	.96	Reject
6	.27	.91	Reject
7	.26	.86	Reject

As Table 8 shows, results of parallel analysis support the decision from the screeplot to retain one factor, as only one demonstrated an eigenvalue exceeding the corresponding criterion values for a randomly generated data matrix of the same size (7 variables x 713 respondents).

The interpretation of one factor is consistent with the authors' view that PWI measures subjective wellbeing (SWB) (International Wellbeing Group, 2006). However, in studies in Australia and overseas, the single stable factor has accounted for approximately 50 per cent of the variance (International Wellbeing Group), lower than the 67 per cent detected in the present sample.

Other psychometric properties of the PWI were also assessed. Researchers have recommended that reliability estimates be calculated with each administration of a scale as "changes in sample characteristics may alter the scale's ability to generate reliable scores" (Vassar & Hale, 2007, p. 487). Internal consistency reliability was therefore assessed using Cronbach's Alpha, revealing a coefficient of .92. Again, this is higher than previously reported coefficients of between .70 and .85 (International Wellbeing Group, 2006). Pearson correlation coefficients for each item ranged from .64 - .81.

To maximise the reliability of a scale, elimination of any item with a loading (correlation between the factor and the item of the scale) less than .4 should be considered (Pallant, 2005). The factor loadings for each of the items on to the factor of SWB are shown below in Table 9.

Table 9

One Factor Solution for the PWI

Questionnaire Items		Factor: SWB
	How satisfied are you with…	
A8.	your future security?	.87
A4.	what you are currently achieving in life?	.87
A6.	how safe you feel?	.83
A2.	your standard of living?	.82
A7.	feeling part of your community	.82
A5.	your personal relationships?	.77
A3.	your health?	.74
Percent of variance explained		66.93
Range of item-total correlations		.64-.81
Cronbach's Alpha		.92

Table 9 shows that all items load quite strongly (above .4), indicating that all items should be retained in the present study.

Core Affect

The Core Affect Scale is a combination of happy/pleased/excited items measuring a single construct (Cummins, Stokes, & Davern, 2007). Results from PCA of the Core Affect Scale were similar to those found with PWI. One component was found to have an eigenvalue exceeding 1 that explained 85.71 per cent of the variance. Again, inspection of the scree plot revealed a clear break after the first component. Table 10 compares actual eigenvalues with values obtained from parallel analysis.

Table 10

Comparison of Eigenvalues from PCA of Core Affect and the Corresponding Criterion Values obtained from Parallel Analysis

Factor Number	Actual Eigenvalue from PCA	Criterion value from Parallel Analysis	Decision
1	2.57	1.06	Accept
2	.35	1.00	Reject
3	.08	.94	Reject

Table 10 shows only one component with an eigenvalue exceeding the corresponding criterion values for a randomly generated data matrix (3 variables x 736 respondents).

Internal consistency for the single factor was assessed using Cronbach's Alpha. As expected Internal consistency was high with a coefficient of .92. Pearson correlation coefficients for each item ranged from .73 - .88.

The loadings for each of the items on to the component of core affect are shown below in Table 11.

Table 11

One Factor Solution for Core Affect

Questionnaire Items		Component Core Affect
B11.	How contented do you generally feel?	.96
B10.	How happy do you generally feel?	.95
B12.	How alert do you generally feel?	.87
Percent of variance explained		85.71
Range of item-total correlations		.73-.88
Cronbach's Alpha		.92

Table 11 shows that all loadings are greater that .4, indicating that all items should be retained in the present study.

Self-Esteem

Rosenberg's Self-Esteem Scale is a uni-dimensional measure of global self-esteem (Rosenberg, Schooler, & Schoenbach, 1989). The scale has demonstrated good reliability and validity across a large number of different sample groups. In the present sample, however, PCA revealed two factors with an eigenvalue exceeding 1 and explaining 56.81 per cent and 12.80 per cent of the variance respectively. An inspection of the scree plot revealed a clear break after the second factor. Using Catell's (1966) scree test, whereby all factors above the break in the plot are retained, it was decided to retain two factors for further investigation. This was further supported by the results of parallel analysis, Table 12.

Table 12

Comparison of Eigenvalues from PCA of Self-Esteem and the Corresponding Criterion Values obtained from Parallel Analysis

Factor Number	Actual Eigenvalue from PCA	Criterion Value from Parallel Analysis	Decision
1	5.68	1.18	Accept
2	1.28	1.13	Accept
3	.56	1.09	Reject
4	.50	1.05	Reject
5	.42	1.01	Reject
6	.36	.98	Reject
7	.35	.95	Reject
8	.31	.91	Reject
9	.27	.87	Reject
10	.26	.83	Reject

Table 12 shows that when eigenvalues are compared to the results of parallel analysis, two factors are confirmed with an eigenvalue exceeding the corresponding criterion values for a randomly generated data matrix of the same size (10 variables x 711 respondents).

To aid in the interpretation of these factors, oblique rotation (Direct Oblimin) was performed. Tabachnik and Fidell (2001) recommend choosing oblique rotation first and then looking at the correlation between the factors. An examination of the factor correlation matrix revealed a correlation of .59. This correlation indicates significant overlap in variance between the two factors, supporting the use of oblique rather than orthogonal rotation. Table 13 shows the results of the rotation in the pattern matrix. The matrix contains values representing the regression coefficient for each item on each factor, and means that shared variance is omitted. In other words, the pattern matrix shows the unique contributions of each factor to the variance in the items (Tabachnick & Fidell).

Table 13

Pattern Matrix from Oblique Rotation for the Self-Esteem Scale

	Questionnaire Items	Factors	
		1	2
C15.	I feel that I have a number of good qualities.	.94	-.12
C16.	I am able to do things as well as most other people.	.88	-.06
C19.	I feel that I'm a person of worth, at least on an equal plane with others.	.83	.04
C13.	On the whole, I am satisfied with myself.	.74	.17
C22.	I take a positive attitude toward myself.	.71	.20
C14.	At times I think I am no good at all.	-.07	.86
C18.	I certainly feel useless at times.	.00	.83
C20.	I wish I could have more respect for myself.	-.01	.82
C17.	I feel I do not have much to be proud of.	.04	.76
C21.	All in all, I am inclined to feel I am a failure.	.23	.70

From Table 13 it is evident that the interpretation of two factors is likely due to negatively worded items, thereby generating two methods factors of low self-esteem and high self-esteem. These factors could be considered subsidiary factors to a super-ordinate factor of general self-esteem. Sometimes, because of the relationships between factors, values in the pattern matrix are suppressed (Field, 2005). Therefore the structure matrix, which is

"a product of the pattern matrix and the matrix containing the correlation coefficients between factors" (Field, p. 660) can be an additional means for interpreting the data, see Table 14. It is recommended that both matrices are reported (Graham, Guthrie, & Thompson, 2003).

Table 14

Structure Matrix from Oblique Rotation for the Self-Esteem Scale

	Factors	
Questionnaire Items	High Self-Esteem	Low Self-Esteem
C15. I feel that I have a number of good qualities.	.88	.44
C19. I feel that I'm a person of worth, at least on an equal plane with others.	.85	.53
C16. I am able to do things as well as most other people.	.84	.46
C13. On the whole, I am satisfied with myself.	.84	.60
C22. I take a positive attitude toward myself.	.83	.62
C21. All in all, I am inclined to feel I am a failure.	.64	.83
C18. I certainly feel useless at times.	.48	.83
C14. At times I think I am no good at all.	.43	.82
C20. I wish I could have more respect for myself.	.47	.82
C17. I feel I do not have much to be proud of.	.48	.78

The structure matrix shown in Table 14 strengthens the case for a one-factor solution for this scale. From the table it is evident that all the items could be considered complex because they have more than one high correlation, indicating that the items are influenced by both factors. This finding, and the high correlation (r = .59) between the two factors, mentioned earlier, supports the variable as measuring the single factor of Self-Esteem, as the authors intended (Rosenberg, Schooler, & Schoenbach, 1989).

Internal consistency for the single factor of Self-Esteem was assessed using Cronbach's Alpha. Internal consistency was high with a Cronbach's Alpha coefficient of .91. Pearson correlation coefficients for each item ranged from .64 - .77.

Self-Efficacy

The Self-Efficacy Scale was developed for the current study. Principal components analysis revealed one factor with an eigenvalue exceeding 1 that explained 53.12 per cent of the variance. An inspection of the scree plot revealed a clear break after the first factor. The finding of one factor was further supported by parallel analysis, shown in Table 15.

Table 15

Comparison of Eigenvalues from PCA of Self-Efficacy and the Corresponding Criterion Values obtained from Parallel Analysis

Factor Number	Actual Eigenvalue from PCA	Criterion Value from Parallel Analysis	Decision
1	4.25	1.16	Accept
2	.83	1.09	Reject
3	.71	1.06	Reject
4	.66	1.02	Reject
5	.51	.98	Reject
6	.43	.94	Reject
7	.34	.90	Reject
8	.27	.85	Reject

Table 15 shows only one factor with an eigenvalue exceeding the corresponding criterion values for a randomly generated data matrix of the same size (8 variables x 701 respondents), supporting the acceptance of one factor.

Internal consistency for the single component was assessed using Cronbach's Alpha. Internal consistency was high with a Cronbach's Alpha coefficient of .87. The loadings for each of the items on to the factor of self-efficacy are shown below in Table 16.

Table 16

One Factor Solution for Self-Efficacy

Factor Number	Actual Eigenvalue from PCA	Criterion Value from Parallel Analysis	Decision
1	4.25	1.16	Accept
2	.83	1.09	Reject
3	.71	1.06	Reject
4	.66	1.02	Reject
5	.51	.98	Reject
6	.43	.94	Reject
7	.34	.90	Reject
8	.27	.85	Reject

Table 16 shows that all loadings are greater that .4, indicating that all items should be retained in the present study.

Problem Areas in Diabetes

The Problem Areas in Diabetes (PAID) scale is intended to measure a single factor, diabetes-related distress (Polonsky et al. 1995). Principal components analysis revealed two factors with an eigenvalue exceeding 1. These factors explained 52.62 per cent and 6.12 per cent of the variance respectively. Inspection of the scree plot also revealed the possibility of two factors. However, parallel analysis did not support the extraction of two factors as Table 17 shows.

Table 17

Comparison of Eigenvalues from PCA of the PAID and the Corresponding Criterion Values obtained from Parallel Analysis

Factor Number	Actual Eigenvalue from PCA	Criterion Value from Parallel Analysis	Decision
1	10.66	1.30	Accept
2	1.22	1.25	Reject
3	.83	1.21	Reject
4	.80	1.17	Reject
5	.72	1.14	Reject

Factor Number	Actual Eigenvalue from PCA	Criterion Value from Parallel Analysis	Decision
6	.67	1.11	Reject
7	.63	1.08	Reject
8	.57	1.06	Reject
9	.50	1.03	Reject
10	.48	1.00	Reject
11	.46	.98	Reject
12	.41	.95	Reject
13	.34	.93	Reject
14	.32	.91	Reject
15	.30	.88	Reject
16	.26	.86	Reject
17	.25	.83	Reject
18	.21	.80	Reject
19	.19	.78	Reject
20	.17	.74	Reject

Table 17 shows only one component with an eigenvalue exceeding the corresponding criterion values for a randomly generated data matrix of the same size (20 variables x 714 respondents). However, given the scree test demonstrated the possibility of two factors, and given the actual eigenvalue for the second factor is only marginally less than the value generated by parallel analysis, it was decided to investigate the possibility of two factors.

To assist with this investigation, oblique rotation (Direct Oblimin) was performed. An examination of the factor correlation matrix revealed a correlation of .57. This correlation indicates significant overlap in variance between the two factors, supporting the use of oblique rather than orthogonal rotation. Table 18 shows the pattern matrix which demonstrates the unique relationship between the factors and each of the items.

Table 18

Pattern Matrix from Oblique Rotation of the PAID

		Factors	
Questionnaire Items		1	2
E36.	Feeling depressed when you think about living with diabetes?	.95	-.13
E38.	Feeling overwhelmed by your diabetes?	.86	.02
E41.	Feeling constantly concerned about food and eating?	.83	-.07
E50.	Feeling 'burned out' by the constant effort needed to manage diabetes?	.83	.00
E42.	Worrying about the future and the possibility of serious complications?	.81	-.03
E33.	Feeling scared when you think about living with diabetes?	.80	.00
E37.	Not knowing if your mood and feelings are related to your diabetes?	.79	-.06
E40.	Feeling angry when you think about living with diabetes?	.79	.01
E46.	Feeling that diabetes is taking up too much of your mental and physical energy every day?	.78	-.04
E43.	Feelings of guilt and anxiety when you get off track with your diabetes management?	.75	.02
E39.	Worrying about low blood sugar reactions?	.68	-.04
E47.	Feeling alone with your diabetes?	.63	.23
E35.	Feelings of deprivation regarding food and meals?	.61	.08
E34.	Uncomfortable situations related to your diabetes care (e.g. people telling you what to eat)?	.50	.26
E49.	Coping with the complications of diabetes?	.49	.25
E44.	Not 'accepting' your diabetes?	.45	.36
E45.	Feeling unsatisfied with your diabetes physician?	-.14	.87
E31.	Not having clear and concrete goals for your diabetes care?	.14	.72
E32.	Feeling discouraged with your diabetes treatment plan?	.23	.67
E48.	Feeling that your friends and family are not supportive of your diabetes management efforts?	.36	.37

From Table 18 it is evident that the majority of items loaded more substantially on to factor one, with item E48 loading nearly equally on both factors and items E45, E31, and E32 loading more strongly onto factor 2. Unfortunately it is not clear what construct these items represent. Whilst the items are forming a determined factor, it is also possible that the negative

phrasing of the questions has led to these items being grouped together. As with the scale measuring self-esteem, the finding of two factors may be related to methods factors. It is therefore also important to examine structure matrix and assess the correlations between items of the scale and the two factors (see Table 19).

Table 19

Structure Matrix from Oblique Rotation of the PAID

		Factor	
	Questionnaire Items	1	2
E36.	Feeling depressed when you think about living with diabetes?	.88	.42
E38.	Feeling overwhelmed by your diabetes?	.87	.52
E50.	Feeling 'burned out' by the constant effort to manage diabetes?	.83	.47
E33.	Feeling scared when you think about living with diabetes?	.80	.46
E40.	Feeling angry when you think about living with diabetes?	.79	.46
E41.	Feeling constantly concerned about food and eating?	.79	.41
E42.	Worrying about the future and the possibility of serious complications?	.70	.43
E46.	Feeling that diabetes is taking up too much of your mental and physical energy every day?	.76	.41
E47.	Feeling alone with your diabetes?	.76	.59
E37.	Not knowing if your mood or feelings are related to your diabetes?	.76	.40
E43.	Feelings of guilt and anxiety when you get off track with your diabetes management?	.76	.44
E39.	Worrying about low blood sugar reactions?	.66	.35
E35.	Feelings of deprivation regarding food and meals?	.65	.43
E44.	Not 'accepting' your diabetes?	.65	.61
E34.	Uncomfortable situations related to your diabetes care (e.g. people telling you what to eat)?	.64	.50
E49.	Coping with complications of diabetes?	.63	.53
E31.	Not having clear and concrete goals for your diabetes care?	.55	.80
E32.	Feeling discouraged with your diabetes treatment plan?	.61	.80
E45.	Feeling unsatisfied with your diabetes physician?	.36	.79
E48.	Feeling that your friends and family are not supportive of your diabetes management efforts?	.58	.58

Table 19 shows that all items have correlations greater than .3 with both factors, indicating that the items are influenced by both factors. This finding and the high correlation (r = .57) between the two factors, mentioned earlier, plus the small number of items loading onto factor 2 (Table 18), supports the scale as measuring the single factor of diabetes –related distress which is consistent with the author's research (Polonsky et al. 1995). As well as identifying the PAID as a single factor, it was also decided to retain item E48. This item has a factor loading less than .4 (Table 18) however, as the loading was only marginally below .4, it was decided to retain it so that comparisons with other studies that have used the PAID could be made if necessary.

Hospital Anxiety and Depression Scale (HADS)

This scale is designed to measure the two factors of anxiety and depression. The 14-items of the HADS were subjected to principal components analysis. Two factors were revealed with eigenvalues exceeding 1, explaining 42.89 per cent and 9.43 per cent of the variance respectively. An inspection of the scree plot revealed a clear break after the second factor and it was decided to retain two factors for further investigation. This decision was further supported when the eigenvalues were compared to those generated by parallel analysis (Table 20).

Table 20

Comparison of Eigenvalues from PCA of the HADS and the Corresponding Criterion Values obtained from Parallel Analysis

Factor Number	Actual Eigenvalue from PCA	Criterion Value from Parallel Analysis	Decision
1	6.00	1.24	Accept
2	1.32	1.18	Accept
3	.98	1.14	Reject
4	.79	1.11	Reject
5	.72	1.07	Reject
6	.67	1.04	Reject
7	.55	1.01	Reject
8	.52	.98	Reject

Factor Number	Actual Eigenvalue from PCA	Criterion Value from Parallel Analysis	Decision
9	.48	.95	Reject
10	.45	.93	Reject
11	.45	.89	Reject
12	.38	.86	Reject
13	.35	.82	Reject
14	.34	.78	Reject

Table 20 shows the acceptance of two factors, each having an eigenvalue exceeding the corresponding criterion values for a randomly generated data matrix of the same size (14 variables x 741 respondents).

To aid in the interpretation of these two factors, oblique rotation (Direct Oblimin) was performed. The correlation between the two factors was -.56 and Table 21 shows the pattern matrix generated by this rotation.

Table 21

Pattern Matrix from Oblique Rotation of HADS

	Questionnaire Items	Factors 1	2
F52.	I still enjoy the things I used to enjoy?	.84	.13
F62.	I look forward with enjoyment to things?	.78	-.05
F54.	I can laugh and see the funny side of things?	.76	.05
F56.	I feel cheerful?	.70	-.04
F60.	I have lost interest in my appearance?	.57	.02
F58.	I feel as if I am slowed down?	.50	-.20
F57.	I can sit at ease and feel relaxed?	.48	-.33
F64.	I can enjoy a good book or radio or TV programme?	.47	-.11
F63.	I get sudden feelings of panic?	-.05	-.87
F59.	I get a sort of frightened feeling like ‘butterflies’ in the stomach?	-.15	-.84
F53.	I get a sort of frightened feeling as if something awful is about to happen?	.06	-.74
F55.	Worrying thoughts go through my mind?	.19	-.66
F51.	I feel tense or ‘wound up’?	.18	-.64
F61.	I feel restless as if I have to be on the move?	.07	-.52

From the pattern matrix shown above it is evident that the first 8-items load strongly onto factor 1, and the next six onto factor 2. The interpretation of the two factors is consistent with previous research on the HADS with depression items loading strongly on factor 1 and anxiety items loading strongly onto factor 2. However, in the present sample Item F57 "I can sit at ease and feel relaxed", designated by the authors as an anxiety item, loads more strongly onto the depression factor. To help make a decision about this item, the correlation coefficients from the structure matrix were examined, Table 22.

Table 22

Structure Matrix from Oblique Rotation of the HADS

		Factors	
	Questionnaire Items	1	2
F62.	I look forward with enjoyment to things?	.81	-.48
F52.	I still enjoy the things I used to enjoy?	.76	-.34
F54.	I can laugh and see the funny side of things?	.73	-.38
F56.	I feel cheerful?	.72	-.43
F57.	I can sit at ease and feel relaxed?	.66	-.59
F58.	I feel as if I am slowed down?	.61	-.48
F60.	I have lost interest in my appearance?	.56	-.30
F64.	I can enjoy a good book or radio or TV programme?	.53	-.37
F63.	I get sudden feelings of panic?	.44	-.84
F53.	I get a sort of frightened feeling as if something awful is about to happen?	.48	-.78
F55.	Worrying thoughts go through my mind?	.57	-.77
F59.	I get a sort of frightened feeling like butterflies in the stomach?	.32	-.76
F51.	I feel tense or 'wound up'?	.54	-.74
F61.	I feel restless as if I have to be on the move?	.36	-.56

The structure matrix, Table 22, shows there is considerable overlap between the two factors. Because item F57 correlates strongly with both factors it was decided to leave the item as an anxiety item, as the authors intended.

Internal consistency for each of the factors was assessed using Cronbach's Alpha. Internal consistency was high for factor 1 (α = .81) and also high for factor 2 (α = 86). The correlation between the two factors, r = -.56, as mentioned earlier, reflects the findings from other empirical studies in which these two mood disorders are often found to coexist (Peyrot, 1997).

The results of this analysis support the use of the depression and anxiety items as separate scales as suggested by the scale authors (Snaith, 2003).

Optimism

The final scale measuring optimism, used three-items from the Life Orientation Test-Revised (LOT-R), (Scheier et al. 1989). These three-items were also examined using principal components analysis. One factor was revealed with an eigenvalue exceeding 1 and explaining 81.79 per cent of the variance. Inspection of the scree plot revealed a clear break after the first factor. Eigenvalues from PCA were then compared to values generated by parallel analysis, Table 23.

Table 23

Comparison of Eigenvalues from PCA of the LOT-R and the Corresponding Criterion Values obtained from Parallel Analysis

Factor Number	Actual Eigenvalue from PCA	Criterion Value from Parallel Analysis	Decision
1	2.45	1.07	Accept
2	.34	1.01	Reject
3	.20	.93	Reject

Parallel analysis confirms the presence of one factor. From Table 16 it is evident that only one factor yielded an eigenvalue greater than the corresponding criterion values for a randomly generated data matrix of the same size (3 variables x 726 respondents).

Internal consistency for the single component was assessed using Cronbach's Alpha. Internal consistency was high with a Cronbach's Alpha coefficient of .89 and the item-total correlations ranged from .73-.81.

The unrotated loadings for each of the items on to the one component are shown below in Table 24.

Table 24

One-Factor Solution for Optimism

	Questionnaire Items	Factor Optimism
G67.	I'm always optimistic about my future.	.92
G68.	Overall, I expect more good things to happen to me than bad.	.92
G65.	In uncertain times I usually expect the best.	.87
Percent of variance explained		81.79
Range of item-total correlations		.73-.81
Cronbach's Alpha		.89

Table 24 shows all items have a loading greater that .4, therefore all items will be retained in the current study.

Baseline Characteristics

Descriptive information, including means and standard deviations were calculated for demographic variables in each group. The characteristics of participants at baseline are shown below in Table 25.

Table 25

Participant Characteristics at Baseline

	Groups				
	Usual Care	DAFNE	χ^2	*df*	*p*
Age in years (SD)	49.80 (14.49)	44.01 (13.53)			
N	538	196			
Years Diagnosed	25.13 (14.29)	16.77 (11.81)			
N	528	194			

	Groups				
	Usual Care	DAFNE	χ^2	*df*	*p*
Diabetes Complications (%)			10.99	1	.00
N	550	196			
Yes	37.0	24.0			
No	63.0	76.0			
Gender			4.30	1	.04
N	541	196			
Male (%)	45.3	36.7			
Female (%)	54.7	63.3			
Relationship Status (%)			6.35	5	.27
N	539	193			
Married	58.4	54.4			
Defacto	7.8	9.8			
Never married	18.0	21.2			
Divorced	8.0	9.8			
Separated	3.0	3.1			
Widowed	4.8	1.6			
Unemployed (%)	3.9	6.2	1.68	1	.20
N	532	193			
Income (%)			9.66	6	.14
N	476	172			
< $15K	10.9	5.8			
$15K - $30K	18.1	14.5			
$31K - $60K	24.2	25.0			
$61K - $90K	19.5	26.7			
$91K - $120K	13.2	14.0			
$121K - $150K	6.9	9.3			
> 150K	7.1	4.7			

Chi-square tests of independence were used to explore the relationship between the two groups and the categorical variables. As Table 25 shows, the DAFNE group have a significantly greater number of females, and the Usual Care group a higher prevalence of people with diabetes complications.

One-way analyses of variance were used to detect differences in age and years diagnosed. Results showed that participants in the DAFNE

programme are younger, $F(1,732) = 23.75$, $p = .00$, and have been diagnosed for fewer years $F(1,720) = 53.05$, $p = .00$.

To ascertain if the baseline differences between the two groups on the above variables are likely to influence subsequent analyses, multivariate analyses of variance were performed, with gender and the presence of complications as independent variables and all the psychological variables plus HbA_{1c} as the dependent variables. Box's M confirmed the data met the assumption of homogeneity of variance-covariance matrices with $F(135, 228498) = 1.24$, $p = .03$, which is not significant at the alpha level of .001.This alpha level is recommended because with large sample sizes Box's M tends to be too strict and inflated Type 1 error rates can occur (Tabachnick & Fidell, 2001). Pillai's Trace indicated significant differences for gender and presence of complications on one or more of the dependent variables, $F(9, 519) = 4.87$, $p = .00$ for gender and $F(9, 520) = 5.02$, $p = .00$ for presence of complications. Univariate tests of each of the dependent variables were then examined and these results are shown in Tables 26 and 27.

Table 26

Univariate ANOVA Examining Gender Differences for the Psychological Variables and HbA_{1c}

	Mean (SD)			
Variable	Male	Female	*F* (9, 520)	*p*
N	217	313		
PWI	70.25 (17.15)	69.22 (18.31)	.34	.56
Core Affect	69.73 (17.75)	67.99 (18.75)	1.43	.23
Self-Esteem	72.42 (18.20)	68.59 (19.83)	4.25	.04
Self-Efficacy	70.72 (15.24)	65.72 (16.53)	11.68	.00
PAID	27.02 (16.51)	33.82 (21.65)	24.06	.00
Depression	4.16 (3.20)	4.46 (3.41)	1.70	.19
Anxiety	5.92 (3.75)	7.42 (4.47)	23.44	.00
Optimism	65.76 (20.28)	62.60 (22.73)	4.21	.04
HbA_{1c}	7.59 (1.02)	7.79 (1.10)	4.56	.03

From Table 26 it is evident that females are more likely to have lower self-esteem and less confidence in managing their diabetes. Being female is also associated with greater distress and anxiety, less optimism and poorer diabetes control reflected in higher HbA_{1c} levels, compared to their male counterparts.

Table 27

Univariate ANOVA Examining Differences in the Psychological Variables and HbA_{1c} for People Living with/without Diabetes Complications

	Presence of Complications			
Variable	Yes [Mean (SD)]	No [Mean (SD)]	*F*(9, 519)	*p*
N	161	368		
PWI	64.94 (19.50)	71.81 (16.52)	14.78	.00
Core Affect	64.80 (20.40)	70.68 (16.90)	10.28	.00
Self-Esteem	66.30 (20.71)	72.19 (18.23)	9.35	.00
Self-Efficacy	68.49 (16.96)	67.52 (15.81)	.47	.49
PAID	31.93 (21.61)	30.43 (20.76)	1.12	.29
Depression	5.37 (3.61)	3.82 (3.06)	20.98	.00
Anxiety	7.48 (4.43)	6.43 (4.12)	3.41	.07
Optimism	60.48 (23.52)	65.63 (20.61)	2.39	.12
HbA_{1c}	7.88 (1.10)	7.62 (1.04)(	4.87	.03

Diabetes complications can be debilitating and it is not surprising that experiencing these problems appears to disadvantage some individuals. From Table 27 it is apparent that the presence of complications is associated with lower wellbeing, core affect, and self-esteem, with higher mean scores on depression. As expected, individuals experiencing complications also demonstrate higher HbA_{1c} levels. Therefore, gender and the presence of complications are associated with significant differences in the variables being studied. It will therefore be necessary to consider these variables as covariates in future analyses.

Bivariate Correlations at Baseline

Bivariate correlations for each of the variables of interest were calculated separately for the usual care and DAFNE groups, to inform the subsequent analyses and assess the impact of age and years diagnosed. The correlation matrix in Table 28 displays some interesting relationships between the variables.

Table 28

Means (M), Standard Deviations (SD), & Bivariate Correlations for Usual Care (above the dividing line) & DAFNE Groups (below the dividing line)

	Measures		1	2	3	4	5	6	7	8	9	10	11
1)	PWI			.87 **	.75 **	.56 **	-.55 **	-.66 **	-.61 **	.63 **	.11 *	.03	-.20 **
2)	Core Affect		.82 **		.77 **	.54 **	-.56 **	-.70 **	-.66 **	.67 **	.11 *	.02	-.17 **
3)	Self-Esteem		.59 **	.64 **		.49 **	-.57 **	-.68 **	-.65 **	.68 **	.08	.04	-.23 **
4)	Self Efficacy		.44 **	.46 **	.40 **		-.65 **	-.48 **	-.54 **	.45 **	.18 **	.21 **	-.35 **
5)	PAID		-.42 **	-.51 **	-.51 **	-.56 **		.57 **	.68 **	-.52 **	-.19 **	-.20 **	.31 **
6)	Depression		-.51 **	-.61 **	-.58 **	-.25 **	.44 **		.68 **	-.57 **	.06	-.01	.23 **
7)	Anxiety		-.45 **	-.56 **	-.53 **	-.22 **	.55 **	.60 **		-.57 **	-.17 **	-.17 **	.24 **
8)	Optimism		.57 **	.61 **	.60 **	.33 **	-.37 **	-.49 **	-.48 **		.13 **	.06	-.18 **
9)	Age		-.01	.12	.04	-.01	-.19 **	-.02	-.27 **	.02		.48 **	-.06
10)	Years Dx		.01	.06	.04	.23 **	-.21 **	-.01	-.14 *	-.03	.28 **		-.00
11)	HbA_{1c}		-.15*	-.13	-.12	-.18 *	.23 **	.15 *	.18 *	-.06	-.09	.07	
	Usual Care	M	69.13	68.15	70.06	70.24	29.76	4.53	6.90	69.13	49.80	25.13	7.61
	N = 533	SD	18.87	19.26	19.67	15.87	21.69	3.45	4.42	18.87	14.48	14.29	1.04
	DAFNE	M	71.11	70.51	70.92	61.42	33.85	3.79	6.44	71.11	44.01	16.77	7.93
	N = 195	SD	14.49	15.37	18.08	15.24	18.86	2.90	3.69	14.49	13.53	11.81	1.11

PWI=Personal Wellbeing Index; PAID=Problem Areas in Diabetes; Years Dx=Years Diagnosed; HbA_{1c}=Glycosylated Heamoglobin

p<.05 level (2-tailed); ** p<.01 level (2-tailed)

As expected, for both groups all the psychological variables are moderately or strongly correlated. Positive emotional states are positively correlated with each other and negatively correlated with the negative mood states of diabetes-related distress, depression, and anxiety.

Self-efficacy, identified in diabetes research as a powerful predictor of self-care behaviours (Kavanagh, Gooley, & Wilson, 1993), has in both groups, a strong negative association with diabetes-related distress. In the usual care group, large negative correlations are also found between self-efficacy and anxiety and depression whilst for the DAFNE group these associations are weaker. This indicates that perceived competence in managing diabetes is inversely related to negative emotional states. The converse is also evident, with self-efficacy in both groups showing medium positive correlations with wellbeing, core affect, self-esteem, and optimism.

In the usual care group, significant small to medium strength correlations are found between the clinical measure, HbA_{1c}, wellbeing, self-efficacy, and diabetes-related distress. The associations in the DAFNE group are weaker but remain significant. The association of wellbeing and HbA_{1c} in this study is an interesting phenomenon, because previous research has not been able to demonstrate a linear relationship between metabolic control and quality of life (Gonder-Frederick, Cox, & Ritterband, 2002). To further investigate this relationship, the two groups were combined into one sample and the data divided into low and high wellbeing scores at baseline, with a cut-off of 60 percentage points for the PWI. Results of bivariate correlations showed that participants with wellbeing scores ≤ 60 percentage points (N=148, M =45.59, S =10.96) no significant association was detected between PWI and HbA_{1c}, (r = .03). However, for participants with a PWI > 60 (N=441, M=78.75, SD=9.08) a small, albeit significant, negative association was found (r = -.19, p = 00).

It is plausible that for participants whose wellbeing is already compromised, having poorer diabetes control does not further adversely influence their quality of life. This may be because more powerful stressors are already exerting an influence, with subjective wellbeing homeostasis either distressed or defeated, and in this psychologically depleted state, poorer

diabetes control is just another problem. But, when wellbeing is higher and people are able to mobilise internal and external resources to maintain homeostasis, having poorer diabetes control registers as a challenging event and is therefore negatively associated with wellbeing.

The remaining associations with HbA_{1c} in Table 28 show that poorer diabetes control is associated with less confidence in being able to manage the illness and with higher levels of distress. This latter finding is not surprising, given that the relationship between high HbA_{1c} levels and long-term diabetes complications is well documented (DCCT Study Group, 1993).

In relation to age and the duration of diabetes, which differ between the two groups at baseline, the correlations with other variables are small but significant. It may therefore be judicious to use one of these variables as a covariate. The reason for not using both variables as covariates is because they correlate significantly with each other (r =.36). Tabachnik and Fidell (2001) advise that covariates should not correlate with each other but rather with the dependent variable. Given that the duration of diabetes is linked to diabetes complications, the presence of which is associated with lower wellbeing, it may be prudent to use this variable as the covariate rather than age.

Differences in the Strength of the Associations

In order to assess whether the strength of the associations between variables was different within the usual care and DAFNE groups, r values were converted to a standard score form (z score) using a statistical table (Pallant, 2005). The z scores for each correlation coefficient for each group were then used to calculate the observed value of z (z_{obs}) using the following equation (Pallant).

$$Z_{obs} = \frac{Z_1 - Z_2}{\sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_2 - 3}}} \qquad \text{(Equation 2)}$$

Where N_1 and N_2 equal the sample size for the DAFNE and usual care groups respectively.

The decision rule to determine significance recommended by Pallant (2005) is if: $-1.96 < Z_{obs} < 1.96$, the correlation coefficients are not statistically significantly different.

When using the above formula to compare the two groups, some differences are found that provide an insight into the groups' characteristics at baseline. In the usual care group, wellbeing shared significantly more of the variance in self-esteem, depression, and anxiety. This group has a higher proportion of people experiencing diabetes complications (Table 25), a challenging agent that is driving down wellbeing. Therefore more participants in the usual care group are likely to be experiencing homeostatic failure resulting in stronger associations between wellbeing, self-esteem, anxiety, and depression.

Other differences detected included a greater covariance between self-efficacy, depression, anxiety, and HbA_{1c} for the usual care group, compared to the DAFNE group. Researchers have reported that self-efficacy is associated with better self-management and lower HbA_{1c} (Kavanagh, Gooley, & Wilson, 1993). It is reasonable to assume that if people are embarking on a 5-day training programme related to improving their diabetes control, that they are unlikely to feel confident in managing the illness. However, it is not known why DAFNE participants' self-efficacy, depression, and anxiety scores explain less of the variance in HbA_{1c} compared to the control group.

Controlling for Core Affect

At .87, the variable core affect, is strongly correlated with PWI. This is a concern as dependent variables should measure a separate aspect of the influence of the independent variable (Tabachnick & Fidell, 2001). To examine the influence of core affect, partial correlations were conducted controlling for this variable (Table 29).

Table 29

Partial Correlations with Core Affect as a Covariate

		1	2	3	4	5	6	7	8	9	10
Usual Care Group											
1)	PWI										
2)	Self-Esteem	.25**									
3)	Self-Efficacy	.20**	.13**								
4)	PAID	-.14**	-.25**	-.50**							
5)	Depression	-.15**	-.31**	-.17**	.31**						
6)	Anxiety	-.09*	-.30**	-.30**	.50**	.41**					
7)	Optimism	.13**	.35**	.14**	-.23**	-.18**	-.23**				
8)	Age	.03	-.01	.15**	-.16**	.19**	-.13**	.08			
9)	Years Dx	.03	.04	.24**	-.22**	.02	-.20**	.07	.48**		
10)	HbA_{1c}	-.10*	-.16**	-.30**	.26**	.15**	.17**	-.09	-.04	.00	
DAFNE Group											
1)	PWI										
2)	Self-Esteem	.14									
3)	Self-Efficacy	.12	.15*								
4)	PAID	-.01	-.28**	-.43**							
5)	Depression	-.03	-.32**	.05	.19**						
6)	Anxiety	.02	-.27**	.05	.38**	.40**					
7)	Optimism	.15*	.34**	.07	-.09	-.18*	-.21**				
8)	Age	-.18*	-.05	-.07	-.16*	.06	-.24**	-.07			
9)	Years Dx	-.06	-.00	.23**	-.21**	.04	-.13	-.09	.28**		
10)	HbA_{1c}	-.08	-.05	-.14	.19*	.09	.13	.02	-.08	.08	

* $p<.05$ level (2-tailed); ** $p<.01$ level (2-tailed)

As the correlation matrix above shows, controlling for core affect diminished the strength of the correlations in both groups between subjective wellbeing and all the other psychological variables (self-esteem, self-efficacy, diabetes-related distress, depression, anxiety, and optimism). In the DAFNE group, apart from optimism, significant correlations between the PWI and these variables did not survive the removal of core affect variance; whilst in the usual care group, which has a greater number of participants, significant correlations remained, albeit diminished in strength.

The reductions in the correlation coefficients were similar for both groups and were in the range of .36-.52 and .32-.48 for the usual care and DAFNE groups respectively. Removing the variance exerted by core affect was associated with a reduction of 25-27% in the shared variance between SWB and self-esteem, depression, anxiety and optimism for the usual care

group and 18-23% for the DAFNE group. Controlling for core affect had less impact on the strength of the relationships between wellbeing, self-efficacy, and diabetes-related distress for both groups. In the usual care group, the reduction for self-efficacy was 13% and 10% in the DAFNE group. For diabetes-related distress, a reduction in shared variance with wellbeing of 10% and 17% for the usual care and DAFNE groups respectively was noted. These differences may indicate that the affective portion of PWI, self-esteem, depression, anxiety, and optimism is more dominating than in the variables of self-efficacy and diabetes-related distress. Perhaps these latter two constructs are more related to cognitions. Self-efficacy measures competence and confidence in managing diabetes, primarily cognitive processes and similarly with the PAID scale, measuring the feelings engendered when one thinks about diabetes is more likely to reflect cognitions rather than affect.

Therefore as core affect perfuses many of the psychological constructs used in this study, it was decided to include the variable as a covariate so that "…a view of the unique shared variance between a wide variety of psychological constructs" (Cummins, Stokes, & Davern, 2007, p. 465) could be established.

Prevalence Of Depression And Anxiety

Descriptive information, including means and standard deviations, was then calculated for each group as shown in Table 30. It can be seen that not only are both groups' mean scores for wellbeing below the range for the Australian population (73.4 - 76.4 percentage points) (Cummins, Hughes, Tomyn, Gibson, Woerner, & Lai, 2007) but the mean scores for the usual care group are below the threshold of 70. The homeostasis theory of wellbeing proposes that group mean scores below 70 points predict an increased prevalence of depression. To test this aspect of the theory, dummy variables were created for depression and anxiety with "0" = yes and "1" = no. Participants with scores greater than 7 on the depression items of the HADS were thereby allocated "0" and similarly those with scores greater than 7 on the anxiety items. Chi square tests were then conducted. Results indicated a higher prevalence of depression in the usual care group, 19.9 % versus 9.7%: χ^2 (1) = 9.82, p = .00, thus supporting the prediction. While the homeostasis

theory of wellbeing is silent on the prevalence of anxiety, 41.1% in the usual care group and 38.5% in the DAFNE group demonstrated scores in the clinical range. The differences between the groups were not significant, χ^2 (1) = .33, p = .57.

Comparison Between the Usual Care and DAFNE Groups

An initial multivariate analysis of variance was performed to explore differences between the two groups in the absence of the covariates. Box's M suggested the data met the assumption of homogeneity of variance-covariance matrices, F (45, 3879193.2) = 1.29, p = .09.

Pillai's Trace revealed there was a significant group difference on one or more of the dependent variables F (9, 515) = 9.50, p = .00. The univariate tests for each of the dependent variables are displayed in Table 30

Table 30

Univariate ANOVA Examining the Differences between the Usual Care and DAFNE Groups

	Groups [Mean (SD)]				
Dependent Variables	Usual care (*N*=356)	DAFNE (N=169)	*F* (1,523)	*p*	Partial Eta^2
PWI	68.95 (18.68)	71.11 (14.49)	2.13	.15	.00
Core Affect	69.02 (18.35)	70.24 (15.36)	.57	.45	.00
Self-esteem	71.30 (19.72)	70.21 (18.30)	.37	.55	.00
Self-efficacy	70.77 (15.26)	61.12 (15.41)	45.44	.00	.08
PAID	29.64 (21.60)	34.53 (18.99)	6.33	.01	.01
Depression	4.34 (3.36)	3.99 (2.97)	1.42	.23	.00
Anxiety	6.73 (4.23)	6.75 (3.74)	.00	.96	.00
Optimism	63.39 (22.62)	66.46 (19.55)	2.29	.13	.00
HbA_{1c}	7.61 (1.07)	7.98 (1.09)	13.55	.00	.03

As Table 30 shows, the variables that show a statistically significant difference are self-efficacy, PAID, and HbA_{1c}. Participants in the DAFNE group had higher HbA_{1c} levels, greater diabetes-related distress, and lower self-efficacy. Having poorer diabetes control, greater distress, and lower

perceived competence in managing their diabetes may have provided the impetus to undertake a DAFNE training programme in the first place. It must also be noted from the partial eta squared values that whilst differences were detected, the effect of group participation was weak for diabetes-related distress and HbA_{1c}, and moderately strong for self-efficacy.

Because of the baseline differences already mentioned, it is important to assess if these differences remained after gender, the presence of complications, core affect, and duration of diabetes are controlled. A MANCOVA was therefore conducted. Preliminary checks ensured that there was no violation of the assumptions of normality, linearity, homogeneity of variances, and homogeneity of regression slopes. Box's M suggested the data had met the assumption of homogeneity of variance-covariance matrices, $F(252, 37857.72.3) = 1.15$, $p=.06$. Pillai's Trace revealed that after adjusting for the covariates no significant differences were detected $F(8, 497) = 1.27$, $p=.26$.

To better understand which covariate (s) is the most influential, separate MANCOVAs were conducted using each covariate separately. The results showed that when core affect was a covariate, significant differences remained for self-efficacy, F (1, 522) = 206.99, p = .00; PAID, F (1, 522) = 277.73, p = .00; HbA_{1c}, F (1, 522) = 14.44, p = .00. However, when years diagnosed was used, HbA_{1c} was no longer significant. Interestingly, when the presence of complications was used as a covariate, different variables reached significance. These variables were PWI, F (1, 522) = 16.05, p = .00; self-esteem, F (1, 522) = 10.51, p = .00; depression, F (1, 522) = 21.08 p = .00; HbA_{1c}, F (1, 522) = 9.69, p = .00. Finally, when gender was a covariate, no differences were detected between the groups. Therefore it would appear that the differences in self-efficacy, PAID and HbA_{1c} are driven by the DAFNE group having a greater proportion of females and when the gender disparity is controlled, the differences between the groups disappear.

Preparation of the Data at the 12-Month Time-Point

The same procedures at baseline (Time $_1$) were conducted at the 12-month time-point (Time $_2$) with the data for each dependent variable screened

by group. Scores for categorical and continuous variables all fell within the possible range. The distributions of the continuous variables were checked for skewness and kurtosis, and analysed for normality (Kolmogorov-Smirnov). An examination of the skewness and kurtosis statistics indicated again that all the continuous variables, with the exception of self-efficacy for the intervention group, were not normally distributed.

As at Time $_1$, univariate outliers were recoded by assigning a raw score one unit larger than the next most extreme score in the distribution (Tabachnick & Fedell, 2001). For the PWI, 14 outliers for the usual care group were recoded and 5 for the DAFNE group. In the data for core affect, 11 outliers were detected in the usual care group and recoded, and 5 in the DAFNE group. In the data for self-esteem, only the usual care group was affected with 5 univariate outliers recoded. Self-efficacy had 5 and 3 outliers for the usual care and DAFNE groups respectively. In the PAID data, 4 outliers were recoded for the usual care group, and 1 for the DAFNE group. The depression variable required 4 and 7 outliers to be recoded for the usual care and DAFNE groups respectively. In the anxiety variable, 6 outliers were recoded for the usual care group and 1 for the DAFNE group. No outliers were detected in either group for optimism. Glycosylated Haemoglobin data for the intervention and usual care groups had 5 and 2 univariate outliers respectively that required recoding.

Upon re-examination of the distributions of the above variables, all skewness and kurtosis statistics were improved with the highest skewness and kurtosis found for depression in the usual care group, 1.22 and 1.20 respectively.

Examination of the scatterplots revealed the data generally met the assumption of linearity. Mahalanobis distance was used to check for multivariate outliers using a cut-off criterion of $p < .001$. The Mahalanobis distance value of 45.50 was greater than the critical value of 27.88 for nine dependent variables, indicating the presence of multivariate outliers. Eleven cases exceeding the critical value in the usual care group were identified and no cases in the DAFNE group. After deleting the 11 cases, Mahalanobis distance was found to be 26.61, below the critical value.

Once again, no patterns were detected for missing data and missing values were managed by excluding cases only as required for the specific analysis.

This study is a repeated measures design, and given the time lapse of 12-months between data collection points, it was not possible to obtain 12-month follow-up data for all participants. The usual care group had 312 participants (data completed at Time 1 [T_1] and Time 2 [T_2]) and 217 non-respondents at 12-months, (T_1 only) whilst the DAFNE group had 79 participants and 115 non-respondents.

To explore whether participants differed from non-respondents at baseline in relation to the categorical variables, chi-square tests of independence were conducted for the usual care and DAFNE groups. The results are shown in Tables 31 and 32.

Table 31

Summary for χ^2 Tests Comparing Categorical Variables for the Usual Care Participants and Non-Respondents at Baseline

	Completed Questionnaires				
	T_1 & T_2	T_1 only	χ^2	*df*	*p*
Diabetes Complications (%)			.15	1	.70
N	349	190			
Present	35.8	64.2			
Absent	37.9	62.1			
Gender			.00	1	.95
N	350	180			
Male (%)	44.9	45.6			
Female (%)	55.1	54.4			
Relationship Status (%)			9.24	5	.10
N	349	179			
Married	62.8	50.3			
Defacto	7.2	8.9			
Never married	14.6	25.1			
Divorced	8.0	7.3			
Separated	2.6	3.9			
Widowed	4.9	4.5			
Unemployed			.69	1	.41

	Completed Questionnaires				
	T_1 & T_2	T_1 only	χ^2	*df*	*p*
N	345	177			
	3.2	5.1			
Income (%)			7.45	6	.28
N	301	166			
< $15K	9.0	13.9			
$15K - $30K	19.6	15.1			
$31K - $60K	25.2	23.5			
$61K - $90K	18.9	19.9			
$91K - $120K	13.3	13.9			
$121K - $150K	5.6	9.0			
> 150K	8.3	4.8			

From Table 31 it is evident that no differences emerged between the respondents who did, or did not complete the T_2 survey. Results for the DAFNE group are shown in Table 32

Table 32

Summary for χ^2 Tests Comparing the Categorical Variables for DAFNE Participants and Non-Respondents at Baseline

	Completed Questionnaires				
	T_1 & T_2	T_1 only	χ^2	*df*	*p*
Diabetes Complications (%)			.00	1	1.0
N	79	117			
Present	24.1	75.9			
Absent	23.9	76.1			
Gender			.21	1	.65
N	79	117			
Male (%)	34.2	38.5			
Female (%)	65.8	61.5			
Relationship Status (%)			5.87	5	.32
N	70	102			
Married	60.5	50.4			
Defacto	10.5	9.4			
Never married	13.2	26.5			
Divorced	10.5	9.4			
Separated	2.6	3.4			

	Completed Questionnaires				
	T_1 & T_2	T_1 only	χ^2	*df*	*p*
Widowed	2.6	.9			
Unemployed (%)			.00	1	1.00
N	76	117			
	6.6	6.0			
Income (%)			6.43	6	.38
N	70	102			
< $15K	7.1	4.9			
$15K - $30K	21.4	9.8			
$31K - $60K	21.4	27.5			
$61K - $90K	21.4	30.4			
$91K - $120K	15.7	12.7			
$121K - $150K	8.6	9.8			
> 150K	4.3	4.9			

As with the usual care group, Table 32 shows that in relation to the demographic variables participants in the usual care and DAFNE groups who completed the questionnaires at both time-points were no different at baseline from their counterparts 'lost' to follow-up.

Multivariate analyses were then undertaken to detect any differences in the continuous variables. Preliminary assumption testing was performed, with Box's M confirming the data met the assumption of homogeneity of variance-covariance matrices, $F(66, 588985.90) = 1.00$, $p = .48$. No violations were noted for normality, linearity, univariate and multivariate outliers, and multicollinearity. Pillai's Trace demonstrated a significant difference in the usual care group between participants and non –respondents, $F(11, 511) = 5.98$, $p = .00$. The univariate analyses, means and standard deviations are shown in Table 33.

Table 33

Univariate ANOVA between Participants and Non-Respondents for the Usual Care Group

Variables	T_1 & T_2 [M (SD)] *N*=312	T_1 only [M (SD)] *N*=201	*F* (1, 511)	*p*
PWI	71.14 (17.84)	65.45 (19.62)	7.37	.01
Core Affect	70.15 (18.30)	64.39 (20.14)	5.34	.02
Self-Esteem	71.65 (19.09)	67.09 (20.28)	10.88	.00
Self-Efficacy	71.48 (14.97))	66.92 (17.06)	14.43	.00
PAID	27.78 (21.08)	34.23 (22.15)	14.86	.00
Depression	4.18 (3.14)	5.24 (3.95)	7.53	.01
Anxiety	6.38 (4.28)	7.97 (4.61)	12.22	.00
Optimism	64.34 (21.91)	60.21 (22.99)	3.26	.07
Age	51.92 (13.46)	45.67 (15.64)	32.99	.00
Years Dx	26.54 (13.94)	22.32 (14.65)	32.45	.00
HbA_{1c}	7.58 (.99)	7.68 (1.14)	10.06	.00

It is evident from the above table that those in the usual care group who completed the questionnaires at both time-points had a healthier psychological profile from those who only completed the baseline data. They had higher wellbeing and core affect scores, higher self-esteem and greater perceived competence in managing their diabetes, as well as less distress, depression, and anxiety. They were also younger, had been diagnosed longer and had better diabetes control as reflected in a lower HbA_{1c} levels.

In contrast, when the DAFNE group was examined, Pillai's Trace demonstrated no significant differences between those who completed questionnaires at both time-points and non-respondents at 12-months, $F(11, 167) = 1.41$, $p = .18$.

Results from the multivariate analyses demonstrate that in future there is a risk of making a Type 2 error. This is because there appears to have been no systematic selection within the DAFNE group at 12-months relating to those people who continued with the study. However, it must be remembered that the absence of significant differences may be due to the small sample size.

In regards to the usual care group, those who continued with the study appear to have a healthier psychological and metabolic profile compared to those who did not respond at 12-months. This risk will need to be taken into consideration when interpreting the final results and it may be necessary to use scores for the baseline variables as covariates.

Repeated Measures

Only participants who completed data at both time-points have been included in the subsequent analyses. Time, group and interaction effects were examined using a two-way ANOVA or ANCOVA with repeated measures on one factor (time). The mean change-scores were obtained by subtracting the means scores at 12-months from those at baseline for both groups. The changes detected in the variables are shown in Table 34.

Table 34

Mean (SD) for Change in Psychological Variables and HbA_{1c} from Baseline to 12-months

Variables			Mean (SD) Change-Scores from Baseline	
	Usual Care: *N*	DAFNE: *N*	Usual Care	DAFNE
PWI	336	75	2.26 (11.46)	6.27 (11.24)
Core Affect	351	79	1.83 (12.38)	4.56 (11.99)
Self-Esteem	332	76	1.48 (11.81)	3.08 (16.15
Self-Efficacy	337	78	1.68 (10.20)	27.68 (13.87)
PAID	323	75	-2.07 (11.22)	-9.57 (14.80)
Depression	345	78	-.26 (2.38)	-.71 (2.50)
Anxiety	343	78	-.31 (2.54)	-1.03 (3.49)
Optimism	349	77	3.97 (15.43)	4.92 (15.87)
HbA_{1c}	259	69	-.04 (.52)	.05 (.81)

From the above table it is evident that all the positive variables improved for both groups with greater increments noted in the DAFNE group. Changes were also detected for negative variables with reductions in distress, depression and anxiety observed for both groups, greater mean changes were again detected for the DAFNE group. The clinical measure of HbA_{1c} demonstrated change in the right direction for the usual care group. However,

this change may be due to participant bias as those with a lower HbA_{1c} at baseline were more likely to complete the 12-month follow-up. Unfortunately the DAFNE group recorded a small increase in HbA_{1c}, in spite of participating in training with the central aim of improving diabetes control.

Two-way repeated measures analyses of variance were conducted to assess if the above differences were significant. The homogeneity of variance assumption was not met for PWI and PAID at 12-months. As the more stringent alpha level of .01 has been used for these variables this strategy should avoid the occurrence of a Type 1 error. The results are shown in Table 35.

Table 35

Summary of Two-Way Repeated Measures ANOVA for the Usual Care and DAFNE Groups from Baseline to 12-months

		Summary Repeated Measures ANOVA			
Variables	*df*	Time *F*(*p*)	Group *F*(*p*)	Group x Time *F*(*p*)	Partial Eta^2 for Group x Time
PWI	(1, 409)	34.26 (.00)	4.64 (.03)	7.56 (.01)	.02
Core Affect	(1, 428)	18.34 (.00)	3.46 (.06)	5.31 (.02)	.01
Self-Esteem	(1, 406)	7.93 (.01)	2.44 (.12)	.98 (.32)	.00
Self-Efficacy	(1, 413)	453.01 (.00)	6.66 (.01)	355.13 (.00)	.46
PAID	(1, 396)	57.56 (.00)	.04 (.83)	23.92 (.00)	.06
Depression	(1, 421)	10.26 (.00)	5.83 (.02)	2.21 (.14)	.01
Anxiety	(1, 419)	15.13 (.00)	1.11 (.29)	4.30 (.04)	.01
Optimism	(1, 424)	20.71 (.00)	2.65 (.10)	.24 (.63)	.00
HbA_{1c}	(1, 326)	.01 (.94)	2.83 (.09)	.84 (.36)	.00

Significant differences were detected, with the DAFNE group showing greater improvements in wellbeing, core affect, self-efficacy, and significant reductions in their distress and anxiety levels. It is evident that the change in self-efficacy is the most outstanding result and using the guidelines proposed by Cohen (1988) for repeated measures (.01 = small, .06 = moderate, and .14 = large effect), the partial eta squared result of .46 represents a very large effect size.

Covariates

As mentioned earlier, core affect can perfuse many psychological constructs, especially those measured in the present study. Because the repeated measures analyses compare scores at two time points, rather than use the core affect score at a single time point, it was decided to use a composite core affect score (average of core affect at Time $_1$ and Time $_2$) as a covariate when comparing all the psychological variables. As in previous analyses, duration of diabetes, gender, and presence of complications were also used as covariates in the following repeated measures ANCOVAs and the results shown in Table 36

Table 36

Summary of repeated measures ANCOVA for Usual Care and DAFNE Groups from Baseline to 12-months with Covariates of Composite Core Affect, Duration of Diabetes, Gender, and Complications

		Summary Repeated Measures ANCOVA			
Variables	*df*	Time	Group	Group x Time	Partial Eta^2
		F(*p*)	*F*(*p*)	*F*(*p*)	for Group x Time
PWI	(1, 389)	7.59 (.01)	.34 (.56)	8.06 (.01)	.02
Self-Esteem	(1, 387)	.23 (.63)	.03 (.86)	1.17 (.28)	.00
Self-Efficacy	(1, 392)	31.72 (.00)	10.26 (.00)	303.07 (.00)	.44
PAID	(1, 375)	10.47 (.00)	.00 (.97)	18.84 (.00)	.05
Depression	(1, 399)	.77 (.38)	1.64 (.20)	1.21 (.27)	.00
Anxiety	(1, 397)	.80 (.37)	.57 (.45)	2.02 (.16)	.01
Optimism	(1, 403)	1.93 (.17)	.32 (.57)	.29(.59)	.00
HbA_{1c}	(1, 321)	1.04 (.31)	3.91 (.05)	.45 (.50)	.00

Table 36 shows that differences detected earlier for wellbeing, self-efficacy and diabetes related distress remain, after adjusting for core affect, duration of diabetes, gender and the presence of complications. The improvements in wellbeing, self-efficacy, and significant reduction in diabetes-related distress are all the more notable when we consider that the DAFNE group is being compared to a biased usual care group, as people in this group who remained in the study had higher wellbeing, greater self-efficacy, and less distress than non-respondents. It would therefore appear that

participation in a DAFNE programme achieves significant and sustainable positive psychological outcomes.

In relation to wellbeing, the theory of SWB homeostasis predicts that the people who should have changed the most are those with the lowest wellbeing scores at baseline. To test this theory the sample was divided into two groups: participants with PWI scores < 70 percentage points and those with scores > 69. Initially it was decided to divide the group into three, incorporating a group with PWI scores less than 50. Unfortunately this was not possible because of the small sample size for the DAFNE group (N = 4). The means (*SD*) are shown below in Table 37

Table 37

Changes in PWI for DAFNE and Usual Care Groups when Mean PWI at Baseline is < 70 & > 69

	Usual Care		DAFNE	
	T_1	T_2	T_1	T_2
PWI < 70	52.41 (13.57)	60.51 (14.48)	55.20 (11.04)	70.87 (11.30)
N	127	127	20	20
PWI > 69	82.52 (7.52)	81.23 (10.17)	79.84 (6.60)	82.70 (9.76)
N	209	209	55	55

Table 37 shows that the mean scores for both groups increased when the PWI cut-off was < 70 percentage points with the DAFNE group recording a greater mean increase. When the PWI scores were higher at baseline, only the DAFNE group showed an increase. To test whether any of these differences were significant, a two-way repeated measures ANOVA was conducted and the results shown in Table 38.

Table 38

Two-way Repeated Measures ANOVA between DAFNE and Usual Care Groups to Detect Changes in PWI when Mean PWI at Baseline is <70 & > 69

		Summary Repeated Measures ANOVA			
Variables	*df*	Time	Group	Group x Time	Partial Eta^2
		F(*p*)	*F*(*p*)	*F*(*p*)	for Group x Time
PWI < 70	(1, 145)	57.05 (.00)	5.16 (.03)	5.78 (.02)	.04
PWI > 69	(1, 262)	1.47 (.23)	.27 (.60)	10.21 (.00)	.04

From the above table it is evident that these results support the homeostasis theory of SWB. When the PWI at baseline is below the threshold of 70 percentage points, indicating that wellbeing homeostasis is being challenged, wellbeing for both groups increases significantly by the 12-month time-point, with a greater increase detected in the DAFNE group (15.67 versus 8.10 percentage points). When the mean baseline wellbeing scores are higher, indicating wellbeing is not threatened, the usual care group's scores are similar at 12-months, whilst the DAFNE group's wellbeing scores have increased marginally. Whilst the increase is much smaller compared to when SWB homeostasis is being defended, (2.86 percentage points) it remains significant.

An Examination of the Quality of Life Domains

In order to extend our understanding of DAFNE participants' increased wellbeing over the duration of the study, the PWI domains were examined. Data related to the seven domains were screened and outliers identified and recoded. This process is shown in Table 39.

Table 39

Number of Outliers Recoded at Baseline and 12-months for the PWI Domains for Usual Care and DAFNE Groups

	Number of outliers recoded			
	Usual Care		DAFNE	
PWI Domains	Time $_1$	Time $_2$	Time $_1$	Time $_2$
Standard of living	5	4	5	6
Health	3	-	2	1
Achieving in life	3	-	1	3
Personal relationships	1	13	4	-
Safety	12	5	3	4
Community connectedness	-	-	-	2
Future security	-	-	-	-

After recoding the skewness and kurtosis values improved as shown in Table 40.

Table 40

Skewness and Kurtosis Values for the PWI Domains after Recoding Outliers at Baseline

Domains	Usual Care				DAFNE			
	Pre recoding		Post recoding		Pre recoding		Post recoding	
	Skew	Kurtosis	Skew	Kurtosis	Skew	Kurtosis	Skew	Kurtosis
1	-.99	.51	-.68	-.49	-1.18	1.39	-.82	.02
2	-.51	-.47	-.51	-.47	.66	-.08	-.58	-.35
3	-.76	.10	-.67	-.19	-.62	.33	-.55	.05
4	-1.02	.38	-.89	-.04	-1.09	1.06	-.94	.43
5	-1.22	1.25	-1.01	.35	-.93	.53	-.93	.53
6	-.74	.11	-.74	.11	-.89	.88	-.81	.49
7	-.77	-.18	-.77	-.18	-.82	.23	-.70	-.21

Code: 1=Standard of living; 2=Health; 3=Achieving in life; 4=Personal relationships; 5=Safety; 6=Community connectedness; 7=Future security

It is evident from Table 40 that the distributions of the PWI domains were improved after recoding the outliers at baseline. This process also achieved improvements at the 12-month time-point as shown in Table 41.

Table 41

Skewness and Kurtosis Values for the PWI Domains after Recoding Outliers at 12-Months

Domains	Usual Care				DAFNE			
	Pre recoding		Post recoding		Pre recoding		Post recoding	
	Skew	Kurtosis	Skew	Kurtosis	Skew	Kurtosis	Skew	Kurtosis
1	-1.14	1.66	-.74	.13	-1.65	4.10	-.69	.65
2	-.80	.07	-.74	-.12	-.85	.16	-.76	-.18
3	-.88	.33	-.88	.33	-1.08	1.11	-.54	-.36
4	-1.12	.74	-.79	-.34	-1.02	.39	-1.02	.39
5	-1.30	1.53	-1.06	.51	-2.13	7.50	-.53	-.40
6	-.83	.35	-.83	.35	-1.62	3.90	-.93	.26
7	-1.00	.44	-1.00	.44	-1.03	.63	-1.03	.63

Code: 1=Standard of living; 2=Health; 3=Achieving in life; 4=Personal relationships; 5=Safety; 6=Community connected ness; 7=Future security

Table 41 shows that in all cases where recoding data was necessary, the distributions improved as indicated by the reductions in skewness and kurtosis values.

After the data were prepared, the means and standard deviations for the domains at baseline and at 12-months were calculated. The results are shown in Table 42. Also included is the normative data from the Australian population (Cummins, Woerner, Gibson, Lai, Weinberg, & Collard, 2007). These ranges of values are the group means scores, ± two standard deviations, from the first 19 surveys dating from 2001 to 2007.

Table 42

Mean (SD) of the PWI and Domains for DAFNE and Usual Care Groups at Baseline and 12-Months and Normative Data for the Australian Population

Variables	Usual Care [Mean (SD)]		DAFNE [Mean (SD)]		Normative
	Time $_1$	Time $_2$	Time $_1$	Time $_2$	Data
PWI	69.22 (18.63)	73.42 (15.66)	71.11 (14.49)	79.50 (11.14)	73.6-76.5
Standard of living	77.16 (17.50)	79.43 (15.16)	77.82 (16.14)	82.88 (11.52)	75.5-79.3
Health	61.97 (22.89)	64.12 (21.35)	64.36 (18.42)	70.90 (16.76)	73.9-76.1
Achieving in life	67.90 (22.11)	70.34 (20.33)	68.21 (19.92)	76.09 (14.87)	71.8-75.5
P. Relationships	73.56 (24.16)	76.12 (20.46)	77.09 (18.62)	80.51 (16.40)	76.9-81.5
Safety	77.63 (19.98)	79.26 (18.65)	80.64 (16.62)	85.96 (11.23)	75.2-81.5
C. Connectedness	68.73 (23.91)	71.50 (21.79)	71.14 (19.22)	78.86 (16.01)	68.8-72.3
Future security	69.17 (23.94)	73.33 (21.29)	71.01 (19.26)	77.22 (18.18)	68.1-73.6

Abbreviations: P. Relationships = Personal relationships; C. Connectedness = Community connectedness

It is evident from Table 42 that participants in both groups experienced an increase in mean scores on all domains. In comparison to the Australian population data, it also appears that apart from the domain of health and personal relationships at 12-months, the DAFNE group's mean scores were higher than those for the Australian population. This is a remarkable benefit from participation in a one-week training programme. To better illustrate this point, the mean PWI and domain scores for the usual care and DAFNE groups at Time $_2$ are plotted against the Australian population and shown in Figure 4. Each vertical grey band represents the normative band of values shown in Table 42.

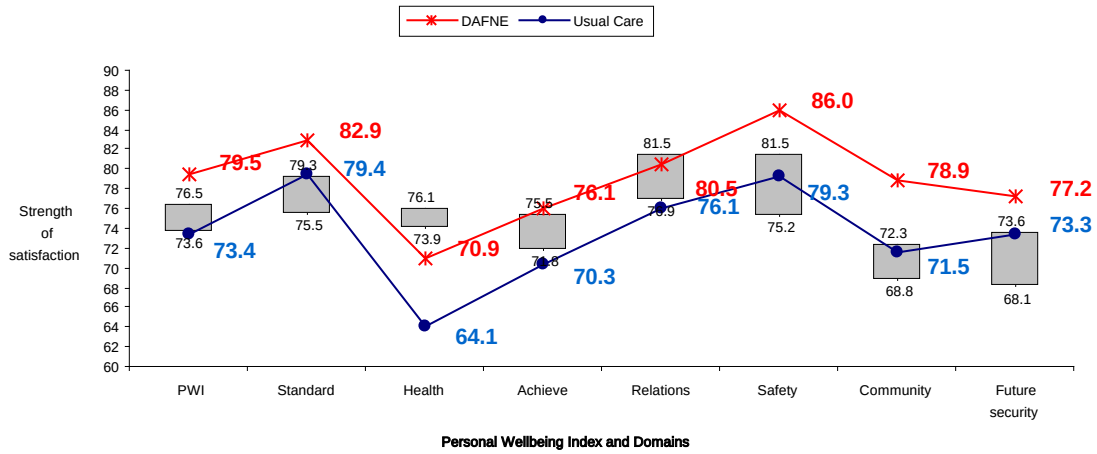


Figure 4. PWI and domains for the usual care and DAFNE groups plotted against normative data for the Australian population.

The above figure shows that people with Type 1 diabetes who have participated in a DAFNE programme score higher than the Australian population on wellbeing and all the domains with the exception of health and personal relationships.

To further assess the differences in the study groups, two-way repeated measures analyses of variance were conducted. Table 43 demonstrates these results.

Table 43

Summary of Repeated Measures ANOVA Comparing PWI Domains at Baseline and 12-Months for the Usual Care and DAFNE Groups

	Summary Repeated Measures ANOVA				
Domains	*df*	Time *F*(*p*)	Group *F*(*p*)	Group x Time *F*(*p*)	Group x Time Partial Eta^2
Standard of living	1, 425	18.20 (.00)	1.30 (.26)	2.64 (.11)	.01
Health	1, 421	16.11 (.00)	3.50 (.06)	4.12 (.04)	.01
Achieving in life	1, 424	22.03 (.00)	1.67 (.20)	6.12 (.01)	.01
P. Relationships	1, 425	6.67 (.01)	2.65 (.10)	.14 (.71)	.00
Safety	1, 422	10.79 (.00)	5.54 (.02)	3.03 (.08)	.01
C. Connectedness	1, 422	21.82 (.00)	3.81 (.05)	4.87 (.03)	.01
Future security	1, 425	21.09 (.00)	1.32 (.25)	.81 (.37)	.00

Abbreviations: P. Relationships = Personal relationships; C. Connectedness = Community connectedness

Levene's tests for all domains were not significant indicating the assumption of homogeneity of variance was met. Significant interaction (Group x Time) effects were detected and the DAFNE group's increase in wellbeing could therefore be attributed to increases in the domains of health, achieving in life, and community connectedness.

Changes in the DAFNE Group over 5 Time-Points

To track the trajectory of the three variables (PWI, self-efficacy, PAID) in which significant improvements were detected, data for the DAFNE group that had been collected at five time-points were examined. These time-points were at baseline, after the 5-day training programme, and 3, 6, and 12-months following completion of the programme. The means and standard deviations at these time-points were calculated and shown in Table 44.

Table 44

Mean (SD) for PWI, Self-Efficacy and PAID for DAFNE Participants at Five Time-Points

Variables	Baseline	At End of Training	3-months	6-months	12-months
PWI (*N*=63)	73.38 (13.24)	77.00(10.56)	77.35 (10.15)	78.57 (11.05)	80.02 (11.73)
Self-Efficacy (*N*=64)	63.01 (15.14)	80.00 (9.83)	81.91 (9.50)	80.00 (10.90)	91.07 (11.86)
PAID (*N*=61)	30.11 (15.38)	21.74 (12.98)	20.50 (12.10)	19.82 (13.43)	19.59 (14.08)

From the above table it is evident that marked changes in all three variables occur by the end of the programme and are then sustained until the 12-month time-point. The data are also shown below in Figure 5

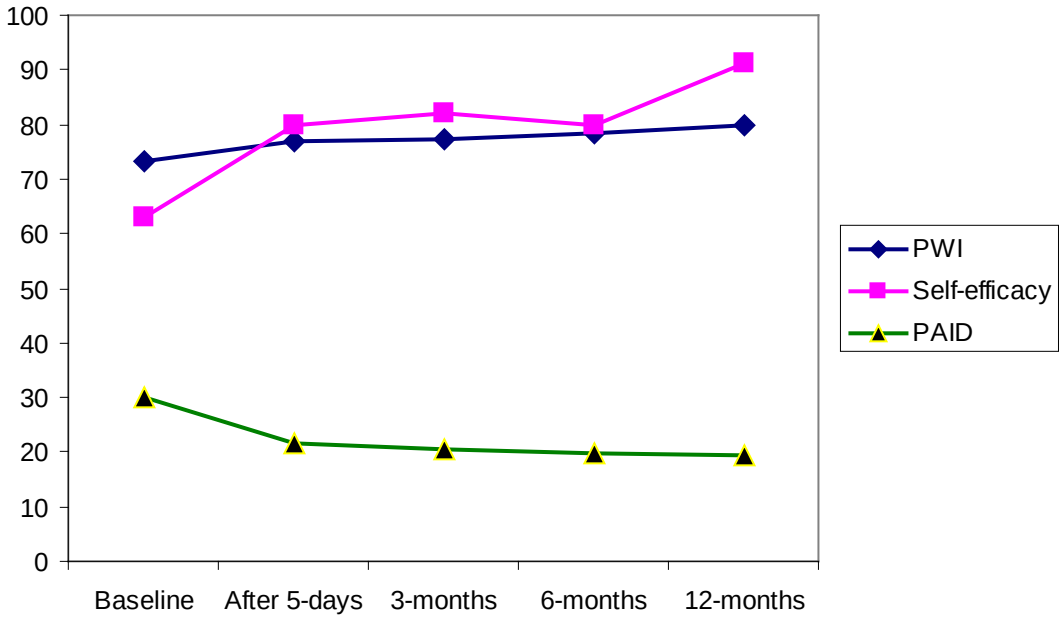


Figure 5. Mean PAID, self-efficacy, and wellbeing scores at 5 time-points for the DAFNE group.

From Figure 5 it is evident that the changes in wellbeing were more subtle than the reductions in distress and increases in self-efficacy. To further investigate these changes, repeated measures analyses of covariance, investigating each variable separately were undertaken. A composite core affect was calculated based on averaging core affect at the five time-points and was used as a covariate in all the analyses.

Personal Wellbeing Index

Mauchly's test indicated the assumption of sphericity was not met, $\chi^2(9) = 18.19$, p = .03; therefore multivariate statistics which do not make the assumption of sphericity were used (Field, 2005). Pillai's Trace showed a significant difference, $F(4, 58) = 6.87$, $p = .00$. Partial eta squared was .32, indicating a large effect size (Cohen, 1988). To detect which time points were different from baseline, the Bonferroni method was chosen. This method has been reported as being the most robust of the univariate techniques for post hoc analyses when the assumption of sphericity is violated (Field).

Whilst it appears from Figure 5, that wellbeing increased immediately after the DAFNE training, an investigation of the pairwise analyses showed that improvements in wellbeing did not actually become significant until 6-months after the programme. Importantly, this improvement was sustained to the 12-month time-point.

Self-Efficacy

Again Mauchly's test indicated the assumption of sphericity was not met, χ^2 (9) = 46.29, p = .00. As expected, Pillai's Trace showed a significant difference $F(4,59) = 68.47$, p= .00 with partial eta squared = .82, indicating a very large effect.

Unlike the increase in wellbeing, significant changes in self-efficacy were more immediate, detectable at the end of the 5-day training programme ($p < .001$). These differences from baseline remained at the 3 and 6-month time-points, and at 12-months, the mean score was significantly higher than at any other time point ($p < .001$). Therefore DAFNE participants continued to experience greater confidence in managing their diabetes as the study progressed.

Diabetes-related Distress (PAID)

Similarly to the other variables, preliminary testing indicated that the assumption of sphericity was not met with a significant Mauchly's test, $\chi^2(9)=24.77$, p= .00. The multivariate test Pillai's Trace showed a significant difference $F(4,56) = 11.34$, p= .00 with partial eta squared = .45 indicating once again a very large effect.

As with self-efficacy, the change in distress appears to occur immediately after the DAFNE training. This is confirmed when pairwise comparisons were examined and significant differences were detected at the end of the 5-day training programme ($p < .001$). These differences from baseline remained at the 3, 6, and 12-month time-points with no significant differences between these three times.

Further Examination of HbA_{1c} Data

As other studies have demonstrated improvements in diabetes control for those participating in DAFNE or similar programmes (DAFNE Study Group, 2002; Mühlhauser & Berger, 2002; Sämaan, Mühlhauser, Bender, Kloos, & Müller, 2005), further examination of the HbA_{1c} data is warranted. To facilitate this process, participants were formed into subgroups according to quartile grouping of HbA_{1c} at baseline. This is shown in Table 45.

Table 45

Mean (SD) for Baseline HbA_{1c} Quartiles for the Usual Care and DAFNE Groups

	Mean (SD) at Time 1		Mean (SD) at Time 2	
Quartiles of baseline HbA_{1c}	Usual Care	DAFNE	Usual Care	DAFNE
1	6.69 (.46)	6.67 (.46)	6.91 (.77)	7.00 (.82)
2	7.67 (.24)	7.69 (.21)	7.59 (.69)	7.79 (.93)
3	8.23 (.15)	8.32 (.21)	8.00 (.65)	8.64 (.80)
4	9.28 (.43)	9.19 (.54)	8.85 (.97)	8.58 (.71)

Table 45 shows that greater change occurs in the upper two quartiles for both groups. To further examine time, group and interaction effects two-way repeated ANOVAs were conducted on one factor (time). Preliminary assumption testing indicated that the data met the assumption of homogeneity of variance and normality. The results are shown in Table 46.

Table 46

Repeated Measures ANOVA Comparing HbA_{1c} Quartiles for the Usual Care and DAFNE Groups

Quartiles of baseline HbA_{1c}	*df*	Summary Repeated Measures ANOVA Time *F*(*p*)	Group *F*(*p*)	Group x Time *F*(*p*)	Partial Eta^2 for Group x Time
1	(1, 131)	13.98 (.00)	.08 (.78)	.68 (.41)	.01
Usual Care *N* = 109					
DAFNE *N* = 24					
2	(1, 104)	.02 (.90)	1.18 (.28)	1.21 (.28)	.01
Usual Care *N* = 83					
DAFNE *N* = 23					
3	(1, 43)	.17 (.68)	7.03 (.01)	5.13 (.03)	.11
Usual Care *N* = 36					
DAFNE *N* = 9					
4	(1, 54)	18.31 (.00)	.99 (.32)	.53 (.47)	.01
Usual Care *N* = 40					
DAFNE *N* = 16					

From the above table it is evident that a significant time X group interaction occurred in the third quartile for the usual care group which demonstrated greater reductions in HbA_{1c} over the 12-months of the study. It should however be noted that the very small sample size for the DAFNE group (*N* = 9) makes any generalisation from this result questionable. The other interesting result shown above is the reduction in HbA_{1c} for both groups for participants in the uppermost quartile. Once again the small sample size for the DAFNE group must be considered, however is does appear that participating in a DAFNE programme did not confer any specific benefits in regards to improved HbA_{1c} levels. Results from the lower quartiles show that with tight glycaemic control, HbA_{1c} remained stable for both groups.

Lack of Improvement in Metabolic Control

As mentioned earlier, self-efficacy has been linked to improved self-management and better glycaemic control. However in this study, in spite of increased confidence in managing the disease, changes in HbA_{1c} levels for the DAFNE group are equivocal at best. There are many lifestyle and instrumental factors that influence diabetes control. These include concurrent illnesses, activity, diet, changes in weight, and quantity of insulin (Peragallo-Dittko,

Godley, & Meyer, 1994). As insulin and body weight data are available, changes in these variables were investigated.

In preparation for the analyses the data were screened by group. Univariate outliers were detected for the amount of daily quick-acting and basal insulin for the usual care group and DAFNE groups. In the usual care group, four participants recorded quick-acting insulin in excess of 120 units per day. These extreme cases were deleted. Two other cases were recoded by assigning a raw score one unit larger than the next most extreme score in the distribution. After these procedures, skewness and kurtosis statistics were .61 and .11 respectively. In the DAFNE group, 6 cases for the quick-acting insulin variable were recoded, after which skewness was found to be .83 and kurtosis .98.The same method was also used for the basal insulin variable with 7 cases in the usual care group recoded leaving skewness at .89 and kurtosis .97. In the DAFNE group 2 cases were recoded after which skewness was found to be .76 and kurtosis .78. In relation to the body weight variable, no outliers were detected for the DAFNE group with skewness .35 and kurtosis -.42. The usual care group had seven outliers that required recoding, resulting in skewness and kurtosis of .26 and -.41 respectively.

Investigation of the variables relating to the number of daily injections of basal and quick-acting insulin revealed that these variables were not normally distributed, with kurtosis values ranging from 7.34 to 12.49. Therefore a non-parametric test, the Friedman Test was used. This test ranks the data and compares the mean ranking at three or more time-points. As the usual care group was only measured at two time-points only the DAFNE group was included in this particular analysis.

Comparisons of Total Daily Insulin and Weight

The means and standard deviations for weight and total daily quick-acting and basal insulin at both time-points are presented in Table 47.

Table 47

Means (SD) for Weight and Daily Amount of Quick Acting and Basal Insulin

Variables	Usual Care Group [Mean (SD)]		DAFNE Group [Mean (SD)]	
	T_1	T_2	T_1	T_2
Quick Acting (daily units)	27.01 (13.53)	26.45 (12.78)	26.73 (12.84)	21.85 (11.42)
N	92	92	65	65
Basal (daily units)	23.06 (10.76)	25.07 (12.40)	24.25 (11.51)	24.93 (12.89)
N	89	89	70	70
Weight	76.57 (13.29)	76.61 (12.97)	74.19 (15.10)	73.25 (14.19)
N	108	108	75	75

Table 47 shows the DAFNE group recorded a larger mean decrease in the amount of quick-acting insulin injected daily. To assess the differences, one-way repeated measures analyses of variance were conducted and the results shown in Table 48.

Table 48

Summary of Repeated Measures ANOVA Comparing DAFNE and Usual Care Groups on Amount of Insulin Injected and Body Weight

	Summary Repeated Measures ANOVA				
Daily Insulin	*df*	Group *F*(*p*)	Time *F*(*p*)	Group x Time *F*(*p*)	Partial Eta^2 Group x Time
Quick Acting	(1, 155)	2.35 (.13)	6.93 (.01)	5.51 (.01)	.03
Basal	(1, 157)	.57 (.45)	.76 (.38)	1.24 (.27)	.01
Weight	(1, 181)	1.99 (.16)	1.51 (.22)	1.86 (.18)	.01

Levene's tests for all variables were not significant, indicating the assumptions of homogeneity of variance were met. Table 48 demonstrates a significant difference in the amount of quick-acting insulin injected daily, with DAFNE participants at 12-months injecting significantly less quick-acting insulin than they were at baseline and compared to the control group. Neither body weight nor the amount of basal insulin injected changed significantly for either group.

Number of Daily Insulin Injections

To examine the changes in the number of daily injections DAFNE participants were administering, the mean ranks for the different insulin were calculated and shown in Table 49.

Table 49

Mean Ranks for Daily Injections of Quick Acting and Basal Insulin for DAFNE participants

Injections / day	Mean Rank (*N*=63)		
	Time 1	Time 2	Time 3
Quick Acting	1.71	2.02	2.27
Basal	1.72	2.13	2.15

Friedman tests found a significant increase in the number of insulin injections administered daily by the DAFNE group for both quick-acting and basal insulin: χ^2 (2) = 19.95, p = .00 and χ^2 (2) = 25.58, p = .00 respectively.

These results suggest that DAFNE participants' increased self-efficacy is reflected in their greater confidence to administer more insulin injections. However, in spite of the increased number of injections, there has been a significant decline in the amount of quick-acting insulin injected daily. As there has not been a concomitant mean loss of body weight (necessitating less insulin), the reduced quick-acting insulin may be contributing to the absence of improved glycaemic control in the DAFNE group.

Regression Analyses

To ascertain the relative importance for the DAFNE group of increased self-efficacy and reduced distress in best predicting changes in wellbeing, a standard multiple regression was undertaken. Using the formula $N > 50 + 8m$ (where m = number of independent variables) it was ascertained that 66 participants were required, thus the present sample of 73 was adequate for the analysis. Additional assumptions of homoscedasticity and independence of residuals were also examined and met. Table 50 shows the results and includes the means (SD), correlation coefficients, unstandardised regression coefficient

(B), the standardised regression coefficients (β), squared semipartial correlations (sr^2), R, and R^2 after entry of the two independent variables.

Table 50

Standard Multiple Regression of Changes in Self-Efficacy and Diabetes-Related Distress on Change in PWI

	Change in PWI (DV)	Change in Self-Efficacy	Change in PAID	*B*	*β*	*sr² (unique)*
Change in Self-Efficacy	.58			.43	.53*	.47
Change in PAID	-.35	-.43		-.09	-.12	-.12
Means	5.89	27.68	-9.57			
SD	11.46	13.87	14.80			
					R^2 = .34	
			Adjusted		**R^2 = .32**	
					R = .59*	

*p<.001

Table 50 shows that both variables explain 32% of the variance in the change in DAFNE participants' wellbeing. This result is highly significant, R = .59, $F(2, 67)$ = 17.49, p =.00.

Comparing the contribution of each independent variable, it is evident that change in self-efficacy makes the largest contribution to change in PWI when the change in diabetes-related distress is controlled β = .53. Furthermore, change in self-efficacy has a part correlation of .47, indicating this variable makes a unique contribution of approximately 22% to the variance in DAFNE participants' improved wellbeing.

CHAPTER 9

DISCUSSION FOR STUDY TWO

This longitudinal and prospective study is the first in Australia, using a control group, to assess the psychological impact of DAFNE training in adults with Type 1 diabetes. The study's results are exciting for proponents of DAFNE as they clearly demonstrate that participating in the programme achieves sustained positive psychological outcomes, namely improved wellbeing and self-efficacy, and reduced diabetes-related distress. However HbA_{1c} levels remained unchanged.

Subjective Wellbeing and Domains

The improvements in quality of life for DAFNE participants, support the findings from the United Kingdom trial which provided the first empirical evidence that DAFNE could improve QOL (DAFNE Study Group, 2002). The present study extends the work of these British researchers by providing a broader insight into some of the factors associated with the improved wellbeing. These additional interpretations have been possible because quality of life in the present study has been measured with a general life satisfaction scale rather than one that is diabetes-specific and health-related. This scale has provided information on the impact of participation in a DAFNE programme on domains that comprise subjective life quality for all people, not just those with diabetes. Furthermore, the DAFNE data have not only been compared to the control group, but also referenced against Australian population data.

The Australian Subjective Wellbeing data, collected from 2001-2008, represents over 35,000 Australians (Cummins, in-press). When the two study groups are referenced against these data, some interesting findings emerge. Twelve-months after completing DAFNE training, participants in this group were not only experiencing greater wellbeing relative to the control group, but, their wellbeing exceeded that of the Australian population. Greater satisfaction was recorded for most of the domains, namely: standard of living, achieving in life, safety, community connectedness and future security. Only one domain,

satisfaction with health, was below the normative range, which is to be expected for people living with diabetes. This profile contrasts with the control group, whose scores were either within or below the normative range, and were similar to the medical condition group in study one. The main point to highlight, however, is that 12-months after being trained in DAFNE, people with Type 1 diabetes, a relentless and demanding condition, are actually scoring higher than the Australian population on most quality of life domains. This demonstrates a truly remarkable impact of a 5-day, skills-based training programme and a worthwhile investment for participants and health professionals alike.

When DAFNE participants are compared against people in the control group, the three domains of satisfaction with health, achieving in life, and community connectedness show the greatest disparity, being significantly higher in the DAFNE group. There are specific DAFNE-related explanations for these differences. Whilst Type 1 diabetes can be associated with devastating complications, having the skills to better manage the day-to-day blood glucose excursions may influence people to believe they can reduce their risk of developing long-term complications. This is a realistic belief given the evidence linking such complications to poor diabetes control (DCCT Study Group, 1993). Belief in one's reduced risk of complications may have increased perceived health for DAFNE participants. This increase offers psychological benefits as self-rated health, irrespective of objective health, is a powerful predictor of mortality (DeSalvo et al. 2005). Furthermore, health has been shown to explain 3-14% of the variance in wellbeing (Michalos, 2004; Okun et al. 1984) further substantiating the psychological benefits associated with improvements in scores on this domain.

Not only did participation in a DAFNE programme provide the opportunity for skills' training but it also provided an opportunity to meet other adults with Type 1 diabetes. Approximately 100,000 Australians have this condition (Australian Institute of Health & Welfare, 2006), and many affected adults complain that they rarely come into contact with others in a similar situation. The increased sense of community connectedness detected

amongst DAFNE participants could possibly reflect a greater affiliation with the diabetes community.

Feeling less isolated and more supported is important for people's psychological health (Penninx et al. 1998) and spending 5-days with both health professionals and people with diabetes provides ample opportunity for positive feedback and clarification regarding diabetes-related issues. Perhaps this dedication to improving ones diabetes management skills may have contributed to the improved satisfaction with the domain achieving in life. Another plausible explanation for the elevated mean scores on this domain is that having a sense of achieving diabetes-related goals, people feel a greater sense of agency to achieve their broader life-goals.

The Wellbeing Trajectory

Understanding the underlying domains related to the increased wellbeing for DAFNE participants provides interesting contextual information. This understanding can be further extended by examining the wellbeing trajectory, formed from data collected at five time-points. From this it appears that wellbeing did not increase immediately, unlike the changes to self-efficacy and distress. Instead, improved wellbeing was only evident six-months after completion of the training, and then sustained for a further six-months. It has also been shown that long-term changes in wellbeing are more likely to be achieved as a result of continuing to do something different rather than as a consequence of changed circumstances (Sheldon & Lyubomirsky, 2006). The present study supports Sheldon and colleagues' findings as the change in DAFNE participants' situation was not related to altered circumstances but rather the activities they were performing to manage their diabetes.

Justification for Using the Personal Wellbeing Index

As shown above, the PWI proved to be a useful tool in this study, although it is often argued that because wellbeing is resilient and not susceptible to change, that general QOL measures are not sensitive enough to assess the impact of disease-specific interventions (Watkins & Connell, 2004).

Contrary to this view, the PWI was able to show in both Study One and this Study that wellbeing homeostasis in people with a chronic illness is threatened. Furthermore, the scale was also able to detect changes in wellbeing associated with completion of a diabetes training programme. These changes were not only evident in people whose wellbeing was below the threshold of 70 percentage points, but smaller increments were also detected in individuals within the normative range. This finding challenges the restricted application of general life satisfaction scales and supports the use of the PWI in health-related clinical research.

Theory of SWB Homeostasis

The theory proposes that SWB is essentially an affective construct. The affective component has been identified as core affect, a steady, stable and biologically determined construct (Davern, Cummins, & Stokes, 2007). The maintenance of subjective wellbeing in the positive range is achieved by homeostatic mechanisms that serve to defend the individual's perception of core affect (Cummins, in-press). This means that various internal and external buffers enable people to keep feeling positive, even in adverse circumstances (Cummins, 2003). When these buffers become overwhelmed in the face of chronic adversity, core affect is not successfully defended and SWB levels fall. So, for people in the present study who reported a SWB score below 70 percentage points, using the theory of SWB homeostasis, this score could be interpreted as evidence that the demands of diabetes were exerting a greater influence on wellbeing rather than internal resources such as positive cognitions.

At the outset of the study, it was predicted that DAFNE training would enable participants to better manage the demands of their disease, thereby contributing to the restoration of psychological equilibrium in those whose SWB homeostasis was persistently defeated. As predicted, people with a baseline PWI less than 70 percentage points achieved an increase of 16 points, 12-months after completion of the DAFNE programme, elevating their mean wellbeing scores over the threshold of 70 points. Whilst those with a SWB above the threshold of 70 also achieved a measurable benefit from the

training, the increments were much lower, at just 3 percentage points. Therefore in people with a chronic illness whose wellbeing is under siege, the psychological benefits of a disease specific intervention appear to be much greater compared to people whose wellbeing is already in the set-point range.

In contrast, participants in the usual care group with lower wellbeing scores, whilst making a recovery of 8 points, still remained below the threshold of 70 points at the completion of the study. This increase could have been related to a regression to the mean at the 12-month time-point. It therefore appears that the provision of the DAFNE intervention provided on average, an additional benefit of at least 8 percentage points to the wellbeing scores of its participants compared to the control group.

Researchers have suggested that the instrumental components of DAFNE, such as frequent blood glucose testing, and self-adjustment of insulin doses, are too demanding for those who are already struggling to manage their diabetes (McIntyre, 2006). The restoration of SWB homeostasis after completion of DAFNE training challenges this view, as the study shows that those who are struggling psychologically, can potentially gain the most benefit. It is therefore important to be careful about making assumptions regarding the best person-DAFNE-fit.

Metabolic Control

It has been known since the landmark study, the Diabetes Complications and Control Trial (DCCT Study Group, 1993), that increasing the frequency of insulin injections improves diabetes control and to date, reducing HbA_{1c} levels is the only way to delay or slow the progression of the microvascular complications of diabetes (DCCT Study Group). However in Europe and the United States 25-50% of adults with Type 1 diabetes do not achieve the glycaemic target of < 7% (DeVries, Snoek, & Heine, 2004; Resnick et al. 2006; Säaddine et al. 2006) and the situation is similar in Australia (Flack & Colagiuri, 2006).

Hence, HbA_{1c} levels are an important outcome measure for diabetes intervention programmes such as DAFNE. To date, all of the published

research evaluating DAFNE and similar programmes has shown improvements to metabolic control. The most recent report investigating over 9,500 people with diabetes over a period of 12-years was able to show a reduction of 0.8% (Sämaan et al. 2005). It is therefore surprising that the present study could not show DAFNE as a two-in-one treatment, that is, an intervention that not only demonstrates psychological benefits but one that also improves glycaemic control (Petrak, 2008).

One explanation is that, whilst DAFNE participants significantly increased the number of daily insulin injections, the amount of quick-acting insulin administered actually decreased. In the European and UK literature where authors have shown improved diabetes control, the amount of insulin administered either increased (Bott et al. 1994; DAFNE Study Group, 2002; Plank et al. 2004) or stayed the same (Pieber et al. 1995). In none of these studies did insulin doses decrease from baseline.

This aspect of the present study is an unexpected phenomenon. In previous research under-insulinisation has been associated most commonly with hypoglycaemia phobia, particularly in people with anxiety (Jacqueminet et al. 2005). Omitting or reducing insulin doses has also been used as a means of weight control. Nearly 10% of women with Type 1 diabetes reduce or omit their insulin to induce glycosuria and subsequent weight loss (Jacqueminet et al.). Whilst hypoglycaemia phobia or concerns about weight and shape were not measured in this study, it is evident that anxiety was an issue for many participants. Approximately 40% of people in both study groups scored above the normal range for anxiety. However, it is not known if the presence of anxiety in the DAFNE group influenced people to give less insulin to avoid hypoglycaemic episodes. The fact that only the DAFNE group reduced their daily insulin, when the prevalence of anxiety was similar in both study groups, suggests a different factor responsible for the discrepancy in insulin dosage. The DAFNE group did have a higher proportion of women, but it is not possible to extrapolate from the study whether there were weight and shape concerns that might have predicted a drop in the amount of insulin administered.

Perhaps a more practical explanation is that, in estimating how much insulin to give at any point in time, the trend amongst the DAFNE participants was to round the dose down. For example, when estimating the insulin dose needed for so many grams of carbohydrate, an individual might calculate 4.5 units. As insulin pens (the most commonly used insulin delivery devices) generally do not have the capacity to deliver half units, a decision would need to be made to round up the insulin dose to 5-units or down to 4-units. If the dose is continually being rounded down, then overall less insulin is likely to be injected. This issue is not present in the usual care group, for whom insulin doses are prescribed in whole units rather than being more accurately titrated to the amount of carbohydrate eaten.

There may also be an underlying belief for both health professionals and DAFNE participants that 'less is better' in regards to the amount of insulin injected. It must be said however that this comment is speculative as there is no supportive evidence from the study. It will be important for the future viability of DAFNE in Australia that further research identifies whether there is a trend for DAFNE participants to administer less insulin after the training. It may also be helpful during the programme to have open and frank discussions regarding participants' beliefs about insulin and for health professionals to reflect on their own attitudes. Identifying people with hypoglycaemia phobia or distorted body image may help to predict those who are more likely to inject less insulin. It may then be possible to address these issues, either individually or during the programme. The end result may be an improvement in diabetes control and the emergence of a two-in-one treatment for people with Type 1 diabetes.

Self-Efficacy and Control

Using the measure specifically developed for this study, it appears that DAFNE training dramatically improves participants' perceived competence and sense of control in relation to managing diabetes. At baseline those in the DAFNE group had lower self-efficacy and greater distress compared to the usual care group. However, this situation was reversed after completion of the intervention. Furthermore, the improvement in self-efficacy and control was

the most influential factor associated with improved wellbeing, predicting 22% of the variance in this variable.

These results support other researchers who have identified self-efficacy (Eiser et al. 2001; Rose et al. 2002; Watkins et al. 2000) and control as correlates of higher quality of life (Cummins & Nistico, 2002). Other researchers have elaborated the benefits of increased self-efficacy to a positive impact on self-care behaviours (Kavanagh, Gooley, & Wilson, 1993) and the flip side, low self-efficacy, has been identified as an important barrier to achieving diabetes-related goals (Peyrot & Rubin, 2007). The study's results were able to provide evidence of a change in behaviour for DAFNE participants as this group was administering more insulin injections per day compared to the usual care group. As has already been discussed, it is disappointing that this change in behaviour did not translate to reduced HbA_{1c} levels.

It would be expected that judgments regarding self-efficacy would be impacted by whether a specific standard was achieved. Thus, in the absence of any improvement in metabolic control, one would predict that over time, self-efficacy would wane. As this study shows evidence to the contrary, there must be another factor(s) underpinning the sustained elevation in self-efficacy. Perhaps the association of self-efficacy with higher levels of wellbeing created a positive feedback loop, where increased perceived competence and control over diabetes was linked to feeling happier, which reinforced the sense of self-efficacy.

Anxiety and Depression

As mentioned in the previous section, low self-efficacy has been associated with difficulty in achieving diabetes-related goals (Peyrot & Rubin, 2007). However, this did not appear to hinder people with diabetes from undertaking a DAFNE programme as the group's mean self-efficacy scores were significantly lower than the control group at baseline. One factor that may be a barrier to participation in a DAFNE programme is the presence of depression. For, whilst the DAFNE group had lower self-efficacy, worse

diabetes control, and greater diabetes-related distress at baseline, the proportion of people scoring in the clinical range for depression was almost half that of the usual care group (10% versus 19%). This high proportion of people experiencing depression in the usual care group is consistent with other research (Anderson et al. 2001). It would be expected that experiencing depression and the avolition that often accompanies the condition (American Psychiatric Association, 2000), would be a significant barrier to participating in a self-management programme. The lower prevalence of depression in the DAFNE group would appear to support this view.

As reported previously, depression has received considerable attention in the diabetes literature. However, an interesting finding in this study is the very high proportion of people in both groups scoring in the clinical range for anxiety (41% in the DAFNE group and 39% in the usual care group). This finding is counter to the general view that the rates of anxiety in populations with diabetes are similar to the rates of depression (Peyrot & Rubin, 1997). Perhaps future research will identify if the prevalence of anxiety is currently being underestimated in people with diabetes.

Given that diabetes-related distress, self-efficacy, and PWI all improved over the duration of the study, and given that all these variables are significantly correlated with anxiety and depression, it is possible that had the DAFNE sample been larger, the results may have shown that the programme was associated with reduced depression and anxiety in vulnerable individuals. Although care is needed with this assumption as authors have suggested it is a mistake to believe a programme will ameliorate a problem for which it is not specifically designed (Bennett, 2004).

Therefore, the study does not show convincingly that DAFNE training can improve anxiety and depression. However the high prevalence of these disorders may highlight to health professionals the need to maintain the delicate balance of educating people with diabetes about the risk of diabetes complications, without exacerbating anxiety in individuals who may already feel burdened by fears and worries about their future health. Currently, the DAFNE programme does not incorporate a psychosocial component in its

curriculum. Given the high prevalence of people scoring in the depressed and anxious range who participated in the programme, it may be helpful to include strategies to identify and manage anxiety and depression.

Limitations of the Study

The study design could have been improved if a wait-listed controlled trial had been used, similar to the United Kingdom DAFNE trial. The reason this was not done was because of the limited time to complete the study, and because the programme is so new in Australia. The novelty of DAFNE meant that diabetes centres were not willing to have participants randomised to a group that was required to wait for 6-months before commencing the programme, as DAFNE facilitators were keen to deliver the programme as quickly as possible.

The attrition rate is also a concern, with data at 12-months not available for 41% of participants in the usual care group and 59% of the DAFNE group. However, it is reassuring that, in the DAFNE group, there were no differences between those who did, or did not complete the questionnaires at 12-months. Unfortunately this was not the case for the usual care group, where those with a healthier psychological profile were more likely to respond at both time-points. These differences make a Type 2 error more likely. So, the fact that significant differences were found makes the study all the more powerful given the DAFNE group were being compared to a group with higher positive affect.

In conclusion, research into the Australian version of DAFNE, shows that powerful mastery experiences, that improve perceived confidence and competence in managing diabetes, can have profound effects that extend over varied quality of life domains.

CHAPTER 10

CONCLUSION AND FINAL SYNTHESIS

The two studies in this thesis examine the impact of chronic illness on subjective wellbeing (SWB). Study One examines a large data set from the Australian Unity Wellbeing Index. It establishes that in Australia, people with a chronic illness experience lower SWB compared to their healthy counterparts. These results support other researchers who have found a sustained and consistently lowered wellbeing associated with ill health (e.g. Mehnert et al. 1990).

Study Two extends the findings of the first study by investigating the impact of an education intervention in people with Type 1 diabetes. The results show that DAFNE, a programme providing resources and enabling guidance, can assist in the recovery of SWB. As a result of the training, participants' self-efficacy and sense of control in managing their diabetes increased, and this appeared to have a strong impact on SWB.

In sum, this thesis shows that whilst wellbeing is vulnerable to adverse stressors such as chronic illness, it is also a dynamic construct and, with the provision of appropriate resources, psychological equilibrium can be regained.

Theoretical Relevance

Both studies provide support for the theory of SWB homeostasis. This theory proposes that, because life satisfaction is maintained within a narrow range, a homeostatic system acts to buffer events or circumstances that have the capacity to threaten the maintenance of SWB. In Study One, there was evidence of a homeostatic mechanism in operation, that of domain compensation. It was found that people with a medical condition were more likely to compensate for dissatisfaction with their health by having greater satisfaction with other life domains such as relationships.

In Study Two, when DAFNE participants were divided into two groups according to whether their wellbeing scores were in the low or normal

range, the greatest improvement occurred in those who were suffering the most. The improvement in SWB of 16 percentage points for the low wellbeing group was truly stunning, especially when compared to an increase of only 2 percentage points in those with normal wellbeing levels. The homeostatic mechanisms that appeared to be the most influential in returning wellbeing to the set-point were cognitions related to perceived competence and control over diabetes. This supports previous work demonstrating the association of perceived control with SWB (Cummins & Nistico, 2002).

Practical Application

People with a chronic illness dominate the health care landscape. As these conditions are not remediable, it is important that other non-medical factors are considered to help people move towards the positive end of the health continuum. If people with Type 1 diabetes are experiencing lower wellbeing then this is a worthy focus of attention especially when it is apparent that positive change to QOL is possible.

The problem in achieving this goal is that, although health professionals generally appreciate the importance of maximising QOL, rarely is it monitored systematically (Snoek & Skinner, 2002). Furthermore, before this can happen, there needs to be greater consensus on how QOL is conceptualised and measured. The HRQOL scales and the diabetes-specific QOL measures represent narrower concepts than the general life satisfaction measures. The domains used in the PWI for example, are domains that are generally considered important in a life of quality for all people, irrespective of whether they are living with a chronic illness or not.

Other researchers are also thinking along these lines. As Snoek says, “The development of valid, reliable, user-friendly quality of life assessment procedures can help facilitate the integration of quality of life measurement into diabetes care.” (Snoek, 2000, p. 24). This thesis has shown the Personal Wellbeing Index to have sufficient sensitivity to detect change in SWB in response to a disease-specific intervention. Therefore, it may be time to incorporate such general SWB measures in health-care practice and research.

Incorporating these kinds of measures into standard health-care, in conjunction with an understanding of SWB homeostasis, could also be useful in a preventative sense. Recognising people whose wellbeing is under threat, may provide health professionals with an opportunity to assist these people to regain their psychological equilibrium before the emergence of psychopathology.

Recommendations for DAFNE

Because of the insufficient numbers of people experiencing depressive and anxiety-related symptoms amongst DAFNE participants, it is not known if participation in the programme can ameliorate the cognitive symptoms associated with these disorders. Further research is therefore recommended as these problems are highly prevalent in people with diabetes (Anderson et al. 2001).

It may also be clinically useful for DAFNE facilitators to encourage participants to carefully monitor the total amount of quick-acting insulin they are administering each day. The thesis identified that DAFNE participants reduced their insulin compared to the usual care group. This phenomenon could have explained the lack of improvement in diabetes control for DAFNE participants, as these results are a direct contrast to studies in the United Kingdom and Europe where reducing insulin dosage has not been reported.

Finally, wellbeing research in people with a chronic illness can improve our understanding of who is happy and why. This kind of research broadens the priorities of health professionals to look beyond laboratory results, and to also think about the impact their interventions and interactions can have on the QOL of people in their care. A health-care system in which health professionals approach people’s physiology, biology and psychology as a unified whole, to not only achieve the best possible medical outcomes, but to also enhance wellbeing, would be a system worth emulating.

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APPENDICES

Appendix A
Plain language statement and consent form for the intervention group

Appendix B
Pre-DAFNE assessment form

Appendix C
Plain language statement for the control group

Appendix D
Questionnaire 1 – ‘About Your Diabetes’

Appendix E
Questionnaire 2 – Psychological variables and demographic information

DEAKIN UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE

PLAIN LANGUAGE STATEMENT FOR DAFNE PARTICIPANTS

Project Title: The psychological impact of DAFNE (Dose Adjustment for Normal Eating) training in adults with Type 1 diabetes

Principal Researcher: Ms Lisa Engel

Principal Supervisor: Professor Robert Cummins

Dear Participant,

You are invited to take part in this research project. Please read this information carefully and feel free to ask questions about any information in the document. Once you understand what the project is about and if you agree to take part in it, you will be asked to sign the consent form. By signing the consent form you indicate that you understand the information and that you give your consent to participate in the research project.

The purpose of this project is to assess if the 5-day DAFNE training programme improves the mental health of adults with Type 1 diabetes who participate in the programme. This project is part of my doctoral thesis.

If you agree to participate in the project you will be asked to complete a series of questionnaires that will take approximately 15-minutes to complete. These questionnaires will include a measure of your satisfaction with life (e.g. *Thinking about your life and circumstances, how satisfied are you with your life as a whole?),* your mood (*e.g. I can laugh and see the funny side of things*), and problems in relation to diabetes (e.g. *I feel constantly concerned about food and* eating). The questionnaires will need to be completed at the beginning and end of the DAFNE programme, and then 3-months, 6-months and 12-months following the programme. You will not be required to attend an appointment to complete the questionnaires at the 3-month and 6-month time-points. Rather, I will send you the questionnaires with a stamped self-addressed envelope included, so that you can return them to me. In order for this to happen, your educator involved in the DAFNE programme will need to give me your name and contact details.

There are unlikely to be any risks from participating in this project. It is possible that if you are experiencing negative moods, completing the questionnaires may make you more aware of these feelings. Therefore a list of organisations will be provided that you may want to contact for advice and support. Seeking further information and support is likely to help you in the long-term but we cannot guarantee that you will receive any benefits from participating in the project.

Any information obtained in connection with this project and that can identify you will remain confidential. It will only be disclosed with your permission, except as required by law. Information will be stored in accordance

with Deakin University guidelines; that is all participants will be provided with a code number and personally identifying information removed. Professor Cummins and myself will have access to the information relating to the research project. This information will be stored for 6-years after which it will be shredded.

If you give us your permission by signing the consent form, we plan to present the results of the study in a peer-reviewed journal. A summary of the study will also be posted on the OZ DAFNE website. In any publication, information will be provided in such a way that you cannot be identified.

In accordance with Australian privacy laws you have the right to access the information about you that is collected and stored at Deakin University. You also have the right to request that any information with which you disagree be corrected. Please contact one of the researchers below if you would like to access your information or to discuss any aspect of the project.

Contact Details:
Lisa Engel: (03) 9521-6397 Mob: 0439 036 847 Email: len@deakin.edu.au

Robert Cummins: 9244-6845 Email: cummins@deakin.edu.au

Participation in any research project is voluntary. If you do not wish to take part you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your routine treatment or your relationship with the organisation providing the DAFNE training.

If you decide to withdraw from this project, please notify a member of the research team (contact details above) before you withdraw. This notice will ensure you are given any information relevant to your health and provided with a debriefing opportunity.

This project will be carried out according to the *National Statement on Ethical Conduct in Research Involving Humans (*June 1999) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies. The ethical aspects of this research project have been approved by the Human Research Ethics Committee of Deakin University.

Thank you for your interest in this project.
Your sincerely

Lisa Engel

DEAKIN UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE

CONSENT FORM:

I, of

Hereby consent to be a participant in a research study to be undertaken by Deakin University in Melbourne.

I understand the purpose of the research is to investigate the psychological impact of Dose Adjustment for Normal Eating (DAFNE) training in adults with Type 1 diabetes.

I acknowledge

1. That the aims, methods, and anticipated benefits, and possible risks/hazards of the research study, have been explained to me.

2. That I voluntarily and freely give my consent to my participation in such a research study.

3. Upon receipt , my questionnaires will be coded and my name and address kept separately from them.

4. Any information I provide will not be made public in any form that could reveal my identity to an outside party i.e. I will remain fully anonymous.

5. I understand that aggregated results will be used for research purposes and may be reported in scientific and academic journals.

6. Individual results **will not** be released to any person except at my request and on my authorisation.

7. That I am free to withdraw my consent at any time during the study, in which event my participation in the research study will immediately cease and any information obtained from me will not be used.

Participant's Signature: _____ Date:

Witness' Signature: _____ Date:

DAFNE Baseline Data Collection

Patient DAFNE Number: ……../…….

1. Date of data collection: ……. / ……. / …….

2. Date of birth: ……. / ……. / …….

3. Gender: Male / Female

4. Ethnicity:

- ☐ White
- ☐ Black
- ☐ Mixed
- ☐ Asian (Indian, Pakistani, Bangladeshi)
- ☐ Chinese
- ☐ Other

5. Year of diagnosis: ……..

6. Course date: ……. / ……. / …….

7.

Test	Date	Result
HbA1c		%
Creatinine		umol/l
Cholesterol		mmol/l
Triglycerides		mmol/l
HDL cholesterol		mmol/l

8. Date of last full annual review (including dilated fundoscopy) ……. / ……. / …….

9. Weight: . . . . . kg

10. Height: . . . . . cm

11. Blood pressure: . . . . . / . . . . . .

12. Current insulin regimen average daily dose:

Quick Acting (QA): . . . . . i.u.

Background Insulin (BI): . . . . . i.u.

Pre-mixed Insulin (Mix): . . . . . i.u.

13. Number of injections per day:

QA: . . . . . .

DAFNE Baseline Data Collection

Patient DAFNE Number: ……../…….

BI: . . . . . .

Mix: . . . . . .

14. Insulin type:
QA: Human / Animal / Analogue
BI: Human / Animal / Lantus / Determir
Mix: Human / Animal / Analogue

15. Is patient being considered for insulin pump therapy? Yes / No

16. Appearance of injection sites – is Lipohypertropy present? Yes / No

17. Medication: Lipid lowering Yes / No
Antiplatelet agent Yes / No
Antihypertensive agent Yes / No

18. Complications prior to DAFNE Yes / No
If yes, please record below which complications are and are not present, and the date of onset for each where applicable.

Type of complication (s) - Date(s) of onset

- ☐ MI . . . . . / . . . . . / . . . . . .
- ☐ Coronary revascularisation . . . . . / . . . . . / . . . . . .
- ☐ Peripheral revascularisation . . . . . / . . . . . / . . . . . .
- ☐ CVA . . . . . / . . . . . / . . . . . .
- ☐ Painful neuropathy . . . . . / . . . . . / . . . . . .
- ☐ Foot ulcer . . . . . / . . . . . / . . . . . .
- ☐ Amputation toe . . . . . / . . . . . / . . . . . .
- ☐ Amputation > toe . . . . . / . . . . . / . . . . . .
- ☐ Retinopathy . . . . . / . . . . . / . . . . . .
- ☐ Proliferative . . . . . / . . . . . / . . . . . .
- ☐ Laser Rx . . . . . / . . . . . / . . . . . .
- ☐ Registered partially sighted . . . . . / . . . . . / . . . . . .

DAFNE Baseline Data Collection

Patient DAFNE Number: ……../…….

☐ Registered blind . . . . . / . . . . . / . . . . . .

☐ Microalbuminuria . . . . . / . . . . . / . . . . . .
(Female = > 3.5 on 2 occasions, at least 1 early morning urine)
(Male = > 2.5 on 2 occasions, at least 1 early morning urine)

☐ Proteinuria . . . . . / . . . . . / . . . . . .
(Dipstick positive and/or ACR > 30 on 2 occasions and/or
> 300mg/l in 24 hours)

☐ Dialysis . . . . . / . . . . . / . . . . . .

☐ Transplantation . . . . . / . . . . . / . . . . . .

19. Have you been pregnant since you have had diabetes? Yes / No

Are you pregnant now? Yes / No

Current gestation (weeks) .....

20. Have you ever had an episode of decompensated diabetes (DKA) requiring admission?

Total number ever: . . . . . .

Number in the last year: . . . . . .

Changes to make pre-course:

_____

_____

_____

_____

_____

_____

_____

Checklist

☐ PAID, HADS, EQ-5D

☐ Course information letter

DAFNE Baseline Data Collection

Patient DAFNE Number: ……../…….

Hypoglycaemia Questionnaire

21. Please note total number of blood tests

a) **Performed** in last 2 weeks . . . . . .

b) **Recorded** (eg written down) in last 2 weeks . . . . . .

22. Have you ever had a hypoglycaemic episode you were unable to treat yourself, ie had someone to help you?

a) Total number in last year . . . . . .

Total number in last 5 years . . . . . .

b) How many of these required paramedic assistance?

Total number in last year . . . . . .

Total number in last 5 years . . . . . .

c) How many of these required A&E attendance or hospital admission?

Total number in last year . . . . . .

Total number in last 5 years . . . . . .

23. Do your symptoms of hypoglycaemia usually occur at a blood glucose level of:

☐ ≥ 3mmol/litre

☐ < 3mmol/litre

☐ Do not feel symptoms

Comments: .....

.....

Data collected by..... **Signature** .....

(print name)

DEAKIN UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE
PLAIN LANGUAGE STATEMENT FOR ADULTS WITH TYPE 1 DIABETES (COMPARISON GROUP)

Project Title: The psychological impact of DAFNE (Dose Adjustment for Normal Eating) training in adults with Type 1 diabetes

Principal Researcher: Ms Lisa Engel
Principal Supervisor: Professor Robert Cummins

Dear Participant,

You are invited to take part in this research project. Please read this information carefully and feel free to contact me regarding any of the following information.

The purpose of this project is to assess whether participating in the 5-day DAFNE training programme improves the mental health of adults with Type 1 diabetes. In order to provide sufficient evidence regarding the benefits of the DAFNE training, it is very important that the project has a comparison group of adults who have not participated in a DAFNE programme. This project is part of my doctoral thesis.

If you agree to participate in the project you will be asked to complete a series of questionnaires that will take approximately 20-minutes to complete. The questionnaires will ask about your mood, *"I feel tense or wound up"*, control over your diabetes, *"How much control do you have in preventing hypoglycaemia?"*, and quality of life, *"How satisfied are you with your standard of living?"* There are also questions related to your diabetes. These questions will help me to assess the relationship between your diabetes and your psychological health. The questionnaires will need to be completed twice; now and 12-months later. You will not be required to attend an appointment to complete the questionnaires in 12-months. Rather, I will send you the questionnaires with a stamped self-addressed envelope included, so that you can return them to me.

There are unlikely to be any risks from participating in this project, however, we cannot guarantee that you will receive any personal benefits from participation. Your participation will however contribute to the knowledge base regarding people with Type 1 diabetes and may benefit the DAFNE programme in the future.

Any information obtained in connection with this project and that can identify you will remain confidential. Only Professor Cummins and myself will have access to the information relating to the research project. Information will only be disclosed with your permission, except as required by law. Information will be stored in accordance with Deakin University guidelines; that is all participants will be provided with a code number and personally identifying information removed. This information will be stored for 7-years after which it will be shredded.

We plan to present the results of this study in a peer-reviewed journal. A summary of the study will also be posted on the Diabetes Australia website. In any publication, information will be provided in such a way that you cannot be identified.

In accordance with Australian privacy laws you have the right to access the information about you that is collected and stored at Deakin University. You also have the right to request that any information with which you disagree be corrected. Please contact myself or Professor Cummins if you would like to access your information or to discuss any aspect of the project.

Contact Details:

Lisa Engel: (03) 9521-6397 Mob: 0439 036 847 Email: len@deakin.edu.au

Robert Cummins: 9244-6845 Email: cummins@deakin.edu.au

Participation in any research project is voluntary. If you do not wish to take part you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage. Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your relationship with Diabetes Australia – Vic. If you decide to withdraw from this project, you just need to let me know and I won't send you the questionnaires in 12-months time.

This project will be carried out according to the *National Statement on Ethical Conduct in Research Involving Humans (*June 1999) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies. This research project has been approved by the Human Research Ethics Committee of Deakin University.

Thank you for your interest in this project.

Yours Sincerely,

Lisa Engel

Should you have any concerns about the conduct of this research project, please contact the Secretary, Ethics Committee, Research Services, Deakin University, 221 Burwood Highway, BURWOOD VIC 3125. Tel (03) 9251 7123 (International +61 3 9251 7123).