A COMPARATIVE STUDY OF THE EFFECTS OF A HEALTH CARE PACKAGE ON KNOWLEDGE, ATTITUDES AND SELF-CARE BEHAVIOURS IN OLDER TAIWANESE ABORIGINAL AND NON-ABORIGINAL ADULTS WITH TYPE 2 DIABETES IN TAIWAN

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by

CHAO, YING-HUA

RN, RM

TAFE in Nursing (National Taichung Nursing College of Department School)
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Principal Supervisor:	Professor Kim Usher
Co-supervisor:	Professor Colin Holmes
Co-supervisor:	Dr Petra Buttner
Research Student Monitor:	Dr Alan Hauquitz

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Abstract

In 2005, the five leading causes of death in Taiwan were malignant neoplasm, cerebrovascular disease, heart disease, diabetes mellitus, and trauma. Of these, diabetes is the most rapidly increasing disease. Older adults are the fastest growing segment of the population; high incidence and prevalence rates of chronic diseases are associated with aging and older adults are likely to require and consume the high cost of long-term care. Taiwanese groups include Non-Aborigines: Holo, Hakkas, Mainlander and Aborigines who total 13 groups. Aborigines have a unique culture, traditional religion and customs, that are all very different from Taiwanese non-Aboriginal people. From a cultural perspective, different ethnic groups may have different "thinking, decisions, and actions in patterned ways" (Leininger, 1985, p.209).

The primary purpose of this study was to test the hypothesis that the diabetes self care knowledge, attitudes and behaviours, medical status, and quality of life of Taiwanese elderly with Type 2 diabetes mellitus, could be improved by the delivery of a specific health care package. The theoretical model used to drive the study was the Health Education Model based on the Revised Pender's Health Promotion Model (RHPM). The secondary purpose of the study was to compare the different ethnic groups and how their lifestyle impacted on their perceptions of diabetes. Comparisons were drawn between the Taiwanese Aborigines and non-Aborigine groups. This study utilised an experimental design with a cluster randomized sample (N=500, included experimental group 241 and control group 259, after three and six months followed-up, N= 485, experimental group 235 and control group 250) of Taiwanese elderly with Type 2 diabetes mellitus. Outpatients from Middle to Northern Taiwan included experimental group from 5 public health centres, 1 private clinic and 1 regional hospital and control group from 1 public health centre, 1 private clinic and 3 regional hospitals.

Data were analyzed using SPSS for Windows, version 12.0 and STATA for Windows, release 8. Five research questionnaires were inquired in the study: Diabetes Personal Data Sheet which includes patient's demographic data and health status; the Rand Social Health Battery and Social Services questionnaire which includes an 11 item self-report scale that provides for social resources and social interaction; the Social Services questionnaire, adapted from the "Structured Interview Guide" (Ervin, 2004) which uses questions focused on the family's experiences of using services from various agencies and social services; the Health perceptions questionnaire (HPQ) (Ware, 1976) which includes 33 self-report items that records perceptions of past, present, and future health, resistance to illness, and attitude toward sickness; the Summary of Diabetes Self-Care Activities (SDACA) which consists of 11 items and 14 additional questions about diet, exercise, self-monitoring of blood glucose, foot care and smoking termination; and the Quality of Life (WHOQOL-Brief-TAIWAN) which contains four domains, and 26 facets include physical, psychological health, social relationship, and environment and which is adapted for use in Taiwan.

The results indicated that the intervention health care package had a strong effect on blood glucose levels and well-controlled levels increased from about 60% to 80% in the intervention group. At 6 months of follow-up medical risk markers for complications were significantly reduced for patients in the intervention group compared to control group. Further, the intervention group improved in exercise, healthy diet choices, and blood glucose data but this had no effect on overall quality of life. Aboriginal participants were more likely than non-Aboriginal participants to understand the complications of diabetes complications other chronic diseases however the Aboriginal participants were less likely than the non-Aboriginal participants to have friends who supported them, attend religious services, participate in voluntary group activities, and eat fruit and vegetables.

The study concluded that the special health care package developed for Taiwanese elderly with Type 2 diabetes mellitus was able to affect diabetes participants' knowledge, attitudes and behaviours and improve clinical data outcomes. The intervention did not however improve participants' quality of life. Further investigation is required to confirm the effects of the intervention in younger patients and patients of other ethnic backgrounds such as foreigners who live in Taiwan.

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CHAPTER 1: INTRODUCTION

1.1 The context of this research

The prevalence and incidence of diabetes is rising globally. Diabetes is now recognized as a major health problem in developed and developing countries with approximately 1 in 20 deaths attributable to the disease (WHO 2005). The latest WHO Global Burden of Disease estimates the worldwide burden in adults to be around 366 million by the year 2030, with approximately two thirds of those persons expected to live in developing countries (WHO 2006). Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism. It is associated with reduced life expectancy, significant morbidity due to specific diabetes related microvascular complications, increased risk of macrovascular complications (ischaemic heart disease, stroke and peripheral vascular disease), and diminished quality of life (WHO 2006). A study was undertaken by Tseng (2004) to determine the mortality rate, causes of death, and standardized mortality ratio (SMR) in Taiwanese people with diabetes in a cohort of 256,036 (118,855 men and 137,181 women, aged 61.2 ± 15.2 years) using the National Health Insurance data collected during the years 1995–1998. This data collection was repeated at the end of 2001(Tseng 2004). The study found that 71.2% of the diabetes-related deaths were not ascribed to diabetes on death certificates in Taiwan. Further, it also found that diabetic men have a higher risk of dying than women with diabetes, and diabetic patients have a higher mortality when compared with the general population.

Poor glycemic control in persons with Type 2 diabetes mellitus has other serious consequences related to cognitive function, psychological status, for example depression, anxiety, and stress, and the likelihood of increased medical complications such as retinopathy, renal failure, neuropathy with the risk of amputation, cardiovascular disease, mortality, and increased medical costs. It is well established that healthy eating, regular physical activity and weight control are

essential for the management of diabetes. Increased physical activity can decrease risks such as central obesity, low cardiovascular-protective high-density lipoprotein cholesterol, and abnormal triglycerides (Kain et al 2003, cited in Hill, 2006; Wangberg 2008). A number of studies have demonstrated the benefits of tighter glycemic control. For example, one study found a decrease in cardiovascular end-points by 25% with intensive treatment (Cohen & Shaw 2007) and the U.K. Prospective Diabetes Study revealed good diabetic control led to a 37% reduction in microvascular complications, a 14% reduction in myocardial infarctions, a 12% reduction in strokes, and a 16% reduction in heart failure (Stratton et al. 2000). However, many people with diabetes struggle to adhere to recommended protocols of self-care and blood glucose management and thus risk the development of dangerous complications (Huang, Wu, Jeng & Lin 2004; Diabetes Prevention Program Research Group 2002). Further, it has been revealed that 50-80% of people with diabetes have deficits in knowledge and self-care skills (Clement 1995). As a result, people with diabetes require at least 2-3 times the health care resources of people who do not have diabetes, and diabetes care accounts for up to 15% of national healthcare budgets (WHO 2003).

The American Diabetes Association (ADA) estimated the national costs of diabetes in the USA for 2002 to be $US 132 billion, increasing to $US 192 billion in 2020 (WHO 2006). Ho et al. (2007), in a retrospective cross-sectional study of a Utah Medicaid population, evaluated the economic impact of self-monitoring of blood glucose (SMBG) in a diabetic Medicaid population between June and December 2001. The main outcome measures were a change from baseline in total healthcare costs and diabetes-related healthcare costs following the initiation of SMBG as measured by a pharmacy claim for glucose monitoring reagent strips. The results from 665 insulin users and 885 oral agent (OA) users showed no short-term economic benefit but the authors claimed that long-term economic return of the impact of self-monitoring may take more than 1 year (Ho et al. 2007). Herman and Collins (2004) estimated the longitudinal direct medical costs

associated with end-stage renal disease (ESRD), a complication of diabetes. They used data from the United States Renal Data System for 1997 and 1998 to estimate monthly Medicare payments for services provided for the 24-month period beginning 12 months prior to the date of first ESRD service. A total of 14,254 patients with diabetes and ESRD were identified for analysis. Medicare payments averaged US$450 per person 12 months prior to initiation of dialysis. In the month before initiation of dialysis, Medicare payments increased to an average of US$5,210 (95% CI: US$5,090, US$5,330) per patient. Medicare payments further increased to an average of US$12,531 per person (95% CI: US$12,368, US$12,695) for the first month of dialysis - a 28-fold increase compared with 12 months earlier. The authors also found that not only are the healthcare costs significant in the year following initiation of dialysis, but the healthcare costs increase substantially in the year prior to initiation of dialysis in persons with diabetes (Manninen, et al., 2004).

Weber et al.(2006) analysed the direct costs to the German statutory health insurance system of Type 2 diabetes treatment, the provision of diagnostic and treatment services over 8 years from 1995–2003 in 3,268 patients from 192 randomly selected practices. Average annual costs for the treatment of diabetes and its complications amounted to 3,180 euros per patient. If this figure is extrapolated to the estimates of Type 2 diabetes prevalence in Germany, this represents 4.6–8.2% of federal health expenditure. Over the study period, costs in this population increased in a near linear fashion from 1,570 euros in year 1 to 4,198 euros in year 8, with follow-up for diabetic complications increasingly accounting for the largest share of the funds (Weber et al. 2006). Similar studies from other European countries have found that diabetes care is very expensive. For example, a study by Jönsson et al. (2005) in the Nordic region found that the average medical costs during the first year of ESRD for a diabetic patient were 53,235 euros.

Yoon et al. (2006) explained that the proportions of people with Type 2 diabetes and obesity have increased throughout Asia, and the rate of increase shows no sign of slowing. They claim

that people in Asia tend to develop diabetes with a lesser degree of obesity at younger ages, suffer longer from the complications of diabetes, and die sooner than people in other regions. This has grave implications for the costs associated with diabetes care for the future. In Taiwan between July 1997 and June 1998, persons with diabetes used 22.1% of the total inpatient hospital days and the treatment of diabetes amounted to 11.5% of all health expenditure (Lin & Lai 2001). It is also interesting to note that 6.2% of all outpatient appointments were taken up by persons with diabetes (Tai 2000). Lin (2001) also analyzed claim data from the Bureau of National Health Insurance for the period from July 1997 to June 1998. The study showed the direct costs of healthcare for the diabetic patients analysed was 11.5% of the total costs of healthcare in Taiwan, and was 4.3 times higher than the average costs of care for non-diabetic individuals.

It is predicted that the number of people with diabetes in Taiwan will swell to as many as 300 million by the year 2025 (Chou et al. 2002). A cost–effectiveness analysis of mass screening for Type 2 diabetes mellitus was performed to decide whether it should be conducted in Taiwan. There is mass screening for Type 2 diabetes, especially in younger subjects, with 5-year inter-screening intervals was considered to be cost-effective in Taiwan (Chen et al. 2000). Hsu et al. reported that the Taiwan government support of the costs and performance of monitoring and delivery of care for patients with diabetes mellitus has led to a sharp growth in "disease management" efforts (Hsu et al. 2004). In particular, Hsu et al. (2004) identified that the Taiwan government support of the costs and performance of monitoring and delivery of care for patients with diabetes mellitus has led to a sharp growth in "disease management" efforts by the Bureau of the National Health Insurance (BNHI) and other healthcare providers. A study by Hsu et al. (2004) demonstrated significant improvements in diabetes care in regard to glycemic control, screening for diabetic retinopathy, foot lesions, peripheral neuropathy, proteinuria, and the monitoring of lipid concentrations by the introduction of the disease management process in

Taiwan. The study used medical claims databases, analyzed 3,836 diabetes patients who did not enroll in the program and 560 (86.02%) patients with diabetes who enrolled in the program from January to June, 2002 in a Christian Hospital in Southern Taiwan. Their results showed that, compared with the patients not enrolled to the program, the enrolled patients had better clinical outcomes over six months. In particular, they reported that the mean total per patient healthcare cost for enrolled patients was NT $ 8,225 less than those patients not enrolled. There appeared to be a low overall use of medical utilization for patients enrolled in the program. In addition, the researchers reported that most of the people with diabetes enrolled in the program appeared to appreciate the intervention and reported a positive response toward the education and self-management skills offered in the hospital. The overall results showed that the implementation of a disease management program was a useful strategy for healthcare providers to better meet the needs of patients with chronic problems and encourage more reasonable utilization of healthcare resources (Hsu et al. 2004).

A recent study by Yang et al. (2007) was undertaken to evaluate the long-term cost-effectiveness of four pharmacological treatment strategies for diabetes: early irbesartan; late irbesartan; amlodipine; and standard hypertensive medication treatment in patients with diabetes, hypertension and microalbuminuria in Taiwan. Their research results showed early irbesartan (initiated in microalbuminuric patients) yielded the largest improvements in life expectancy (0.78 years) compared with standard treatment. Late irbesartan and amlodipine (started in patients with overt nephropathy) also resulted in slight improvements in life expectancy (0.109 and 0.001 years, respectively). Both early and late irbesartan reduced lifetime costs compared with control (US$7,603 and US$3,233, respectively), whereas amlodipine increased lifetime costs by US$300. Improvements were attributed to reductions in the cumulative incidence of end-stage renal disease (ESRD) with early use of irbesartan. The researchers recommended treating hypertensive diabetic patients with irbesartan early as it is projected to be life extending and cost

saving, and estimated to reduce the incidence of ESRD in Taiwan (Yang et al. 2007). A study by Chen et al. (2000) demonstrated that mass screening for Type 2 diabetes mellitus, especially in younger subjects, with 5-year inter-screening interval, is cost-effective in Taiwan. This is another means of helping to identify people with diabetes sooner. As a result, it not only reduces the likelihood of complications and shortened life expectancy, but reduces the economic costs associated with the disease.

Yang et al. (2001) explained that diabetes mellitus carries a great burden on healthcare costs in Taiwan due to the growing population of people with diabetes and its associated high co-morbidity. This is especially the case for patients who develop end-stage renal disease (ESRD).Their study explored the effect of diabetes on economic costs in dialysis therapy in Taiwan. At the end of 1997, there were 22,027 ESRD patients with a prevalence and incidence rate of 1013 and 253 per million populations, respectively. Diabetic nephropathy is the second most common cause of underlying renal disease and accounts for 24.8% of the prevalence and 35.9% of the incidence of ESRD. Diabetic patients resulted in 11.8% more expense for dialysis care than the non-diabetic patients (US$26, 988 vs. US$24,146 per patient-year). Higher inpatient costs, mainly account for this difference. For example, when compared to non-diabetic patients, the diabetic patients had 3.5 times more inpatients costs (US$1325 vs. US$4677 per patient-year), and higher proportion of inpatient-to-annualized cost ratio (5.5 vs. 17.3%) resulting from their more frequent hospitalization (0.59 vs. 1.13 times per patient-year) and longer hospital stay (6.7 vs. 18.9 days per patient-year). Major causes of more frequent hospitalization were identified as cardiovascular disease, poorly controlled hyperglycemia, sepsis and failure of vascular access. The annualized costs for care of dialysis patients in Taiwan, including inpatient and outpatient costs, averaged US$25,576 per patient-year (Yang et al. 2001).

Maintaining the required lifestyle changes to prevent the development of diabetes associated complications is challenging (Simpson, Shaw & Zimmet 2003), especially in situations where

patients may have limited health education and support, and particularly for certain groups. For example, this is a problem of particular relevance to the elderly in Taiwan, especially those living in rural and remote regions, and those without family support. A recent study of coronary artery disease in people with diabetes in Taiwan (Chen & Li 2007) found regional differences in the risk associated with a coronary event. The research found that those living and working in rural areas had elevated risks of coronary artery disease when compared to those living in the urban areas of Taiwan. This may indicate that health services for people in rural areas are not as readily available or alternatively, not as well resourced as those in urban areas. Education programs are considered pivotal to improving the outcomes of people with diabetes. A number of health care programs have been implemented but with inconsistent results so far (Gagliardino & Etchegoyen 2001; Bannister et al. 2004; Gabbay et al. 2006; Tien et al. 2008). It was proposed that an educational intervention aimed at reducing the modifiable risk factors such as inactivity, poor glycemic control and poor diet, may help reduce the risk and costs of diabetes and its associated complications in the elderly in Taiwan.

This research has used a follow-up study using a cluster experimental design to examine the effect of a health care package on an individual's knowledge, attitudes, self-care behaviours, and blood glucose control after 3 and 6 months. A total of 30 health care facilities (20 randomly selected local health centres, five private clinics and five regional hospitals) listed with the non-governmental Diabetes Shared Care Networks of Taiwan were approached for collaboration and 12 agreed (6 local health centres, two private clinics and four regional hospitals). The 12 participating health care facilities became the randomised clusters for the study.

1.1-1 Diabetes Introduction and Classification

The classification of diabetes is based on aetiological types (WHO 2003). There are two main

types of diabetes: Type 1 and Type 2. Type 1, or insulin dependent diabetes, usually develops in young people under 30 years of age. Previously called juvenile diabetes, it is characterised by rapid onset of weight loss and osmotic symptoms such as polyuria and excessive thirst, which can progress to diabetic ketoacidosis if not diagnosed early. Type 1 diabetes is caused by destruction of the insulin-producing beta cells in the pancreas by an autoimmune process where the body's immune system is triggered to react against and destroy the insulin-producing cells (Harrison et al. 2008). The cause of this process, not completely understood (Williams & Pickup 1999; Rahman, Rahman, Ismail & Rashid 2007), has catastrophic results because insulin is required to suppress the production of glucose by the liver and to stimulate the uptake and metabolism of glucose by many tissues (Harrison et al. 2008). The outcome of this destruction is complete insulin deficiency leading to the need for insulin replacement therapy for survival (WHO 2003). It is essential that patients with type 1 diabetes continue with insulin, otherwise they may develop diabetic ketoacidosis, which can occur in the absence of insulin even without food intake (Hill 2006). Type 1 diabetes accounts for up to 15% of all diabetes and is increasing in incidence especially in children less than five years of age. It is one of the most common chronic, life-long disorders beginning in childhood (Harrison et al. 2008).

Type 2 diabetes is characterized by disorders of insulin action and /or insulin secretion (WHO 2003). Previously called adult- or maturity-onset diabetes, it is due to defective metabolism of glucose by the body's tissues, with resistance of the tissues to the effects of insulin and a relative deficiency of insulin (Harrison et al. 2008). Type 2 diabetes, in contrast to Type 1, is a progressive condition that is initially characterised by insulin resistance. Beta cells continue to produce insulin but muscle and adipose tissue are relatively insensitive to its action. This results in the beta cells increasing insulin production, which leads to gradual beta cell failure. Type 2 diabetes is by far the most common form of diabetes and treatment is centred on the

introduction of lifestyle changes such as diet and exercise (WHO 2005). Raised total cholesterol, low high-density lipoprotein, hypertension, and abnormal blood glucose results are all features of Type 2 diabetes.

Diabetes mellitus is a lifelong condition that requires long-term management. It is a major cause of morbidity and mortality, often brought about by diabetic microvascular (retinopathy, nephropathy and neuropathy) and macrovascular (peripheral vascular disease, cardiovascular disease and stroke) complications.(Meetoo 2004). Type 2 diabetes is a cluster of conditions referred to as the 'metabolic syndrome', which include elevated plasma glucose, dyslipidemia, hypertension and abdominal obesity (Lunchsinger 2006). Metabolic syndrome incorporates insulin resistance, which can include impaired glucose tolerance or Type 2 diabetes. These conditions increase the risk of cardiovascular disease, and require treatment with polypharmacy. Concordance with medication presents associated challenges for diabetes management (Williams & Pickup 1999, cited in Hill 2006). Causes of Type 2 diabetes are considered unknown, although there appears to be a strong genetic component which is unmasked by lifestyle factors such as eating behaviour, obesity, and inactivity which precipitate the disease. Type 2 diabetes accounts for 85-90% of all diabetes and the number of cases is increasing rapidly in both developed and developing countries. In Australia, there has been a 300% increase in the number of people with Type 2 diabetes in the last 20 years (Harrison et al. 2008). The prevalence of diabetes in adults in the 30-40 years age group in Taiwan is 10% which means there are approximately 900,000 people with diabetes in Taiwan in this age group. The annual incidence is stated as 0.5-1% of Taiwan’s total population and the figure increases to 0.9-1.8% in the over 30 year age group (Tai 2000). Chinese people in Taiwan have a higher prevalence rate of diabetes than those living in mainland China and also higher than other Asian populations such as Vietnam and Korea, but similar to those of Hong Kong and Japan (Chang et al. 2000).

1.1-2 Diabetes Diagnosis

The World Health Organization (WHO 2006) criteria of fasting plasma glucose of ≥7.0mmol/l (126mg/dl) or 2–h plasma glucose ≥ 11.1mmol/l (200mg/dl) is used for diagnosing diabetes. However, according to Taiwan's Department of Health (DOH), fasting blood glucose (AC) should be controlled at 80-120 mg/dl and blood glucose at 2 hours after meal (PC) should be between 80 -160 mg/dl (DOH 2004). As this study was conducted in Taiwan, the Taiwan criteria were incorporated into the study criteria. To be diagnosed with diabetes requires an abnormal fasting plasma glucose reading on 2 separate occasions in asymptomatic persons. Persons with impaired glucose fasting or impaired glucose tolerance are referred to as those with pre-diabetes (Cohen & Shaw 2007).

1.1-3 Diabetes High Risk Groups

There are certain groups of people who have a greater risk of developing diabetes. Australian Aboriginal and Torres Strait Islander people are included in this group. In Australia, diabetes affects over 7% of the total population: at least 15% of people over 55 years of age and up to 30% of some Aboriginal and Torres Strait Islander communities (Diabetes Research Consultative Committee 2002). Type 2 diabetes is a significant health problem for Indigenous people with a likely prevalence among Indigenous people of between 10-30% - around 2-4 times that expected for non-Indigenous Australians. Australia-wide in 2003-04, age-adjusted hospitalisation rates of Indigenous males and females for Type 2 diabetes as the principal diagnosis were 8 and 10 times higher than those of non-Indigenous males and females. Indigenous people have a high prevalence of risk factors known to be important in the development of Type 2 diabetes such as obesity, impaired glucose tolerance, hypertriglyceridaemia, hypertension and hyperinsulinaemia. Of importance also are the poor socioeconomic circumstances of many Indigenous people which impact negatively on psychosocial pathways, involving stress, social support and social cohesion,

social affiliations, early emotional development and social status (Australian Indigenous HealthInfonet 2007). Hanley (2008) pointed out how Indigenous populations around the world (defined by the United Nations as distinct, precolonial ethnic/cultural groups with strong attachments to ancestral territories) experience remarkably high rates of Type 2 diabetes, related complications and risk factors. This increasing burden of diabetes and associated morbidities among the world's Indigenous groups, according to Hanley (2008), highlights the urgent need for: (1) Comprehensive, evidence-based programs for the clinical management of Type 2 diabetes in Indigenous populations, and (2) Culturally appropriate, community-based intervention programs focusing on primary prevention. The author also indicated that Torres Strait Islanders have a diabetes prevalence rate of 26%, which is 6-fold higher than in the general population of Australia. There is currently no available information on the prevalence of diabetes in the Aboriginal peoples in Taiwan. However, we do know that those people living in the rural areas of Taiwan have been found to have a higher likelihood of diabetes, which may be accounted for in some way by the higher numbers of Aboriginal people living in those areas (Chen & Li 2006).

Groups with culturally and linguistically diverse backgrounds have also been found to have incidence rates 40 per cent higher than in the general population. Australian Indigenous females, for example, are 50 per cent more likely than other females to die from diabetes and related problems. People from low socioeconomic groups also experience incidence rates 2.5 times higher when compared with higher socioeconomic groups and those aged over 40 years (DOH 2007) are also more likely to develop diabetes than younger people.

Deprivation is also linked to the development of diabetes. A study by Wild et al.(2008) examined the influence of deprivation on prevalence of diabetes and cardiovascular disease risk factors in people with diabetes. They identified that the prevalence of Type 2 diabetes, obesity, smoking and cardiovascular disease are all higher in deprived populations than in more affluent

groups (Wild et al. 2008). The study reported a rise in incidence rates in deprived populations to 3.2% with the prevalence of obesity increased in the most deprived quintile of people with diabetes. The authors argue that obesity is an important factor in the link between deprivation and the development of Type 2 diabetes (Wild et al. 2008).

1.1-4 Diabetes Symptoms and Complications

Diabetes symptoms vary between Type 1 and Type 2.

Type 1 diabetes may occur suddenly and the symptoms include the following: excessive thirst, frequent urination including bedwetting, excessive hunger, unexplained weakness and fatigue, weight loss, blurred vision, vaginal discharge or itch in young girls, and, nausea and vomiting (Health Insite 2007a).

Type 2 diabetes tends to have a more gradual onset and can often be missed or mistaken as part of the normal aging process. These symptoms include the following: blurred vision, tiredness, urinating more frequently, feeling thirst all of the time, numbness and tingling in the feet or legs, and recurrent infections (Health Insite, 2007a).

Poor control of diabetes leads to the development of a range of serious complications. These complications can be divided broadly into two groups: microvascular and macrovascular complications. Microvascular complications such as retinopathy or vision disorders (glaucoma, cataract and corneal disease), nephropathy (kidney disease) and neuropathy (nerve damage). Macrovascular complications include ischaemic heart disease, cerebrovascular disease and peripheral vascular diseases which can lead to ulcers, gangrene and amputations. Other diabetic complications include infections, metabolic problems, impotence, autonomic neuropathy, problems of pregnancy (Health Insite 2007b) and, an increase likelihood of hip fracture (Chen, Ho & Li 2008).

Approximately 70 per cent of people with Type 2 diabetes die from cardiovascular disease (Hill 2006), the major cause of morbidity and mortality in persons with diabetes (Rahman et al. 2007). The level of risk for myocardial infarction (MI) in patients with Type 2 diabetes is equal to that of someone without diabetes who has already had an MI (Haffner et al 1998, cited Hill 2006), indicating that patients with Type 2 diabetes are at high risk of serious secondary complications. This has an overwhelming effect on an individual's sense of well being. While the mechanisms underlying the development of vascular changes are still not fully understood, it is known that dysregulation of metabolism in diabetes adversely affects every cellular element within the vascular wall by endothelial dysfunction, vasoconstriction and inflammation which in turn promotes the development of macrovascular disorders (Rahman et al. 2007).

The development of a recent predictive model may assist with the prediction of diabetic complications in the future. Maxion-Bergemann et al. (2006) conducted an analysis of the internal validity of a proposed Diabetes Mellitus Model (DMM), which is an epidemiological simulation model for the prediction of short and long-term complications of diabetes. For validation of the model, mean values and confidence intervals (CIs) of simulated event rates (ERs) were calculated. The expected ERs were derived from current publications. Internal validity of the DMM was defined as an agreement (overlap) between the model outputs and the published data allowing for a range of 25% deviation from the original data. The results of the validation process revealed coherence between mean simulated ERs and expected ERs for most of the examined events. A fit of the range of CIs within the range of expected ERs can be observed for macular oedema in type 1 and Type 2 diabetes, for retinopathy in type 1 diabetes, and for amputation and diabetic foot syndrome in Type 2 diabetes. With the exception of end-stage renal disease, the CIs and ranges of the other events overlap significantly, supporting the view that the model can be considered as internally valid. These results substantiate the DMM as an internally valid diabetes model that predicts complication rates consistent with

observed rates. They suggested the DMM is a valuable tool for medical and allied health decision-making around diabetes prediction (Maxion-Bergemann et al. 2006).

1.1-5 Type 2 Diabetes Treatment and Nursing Care

Type 2 diabetes can involve both insulin resistance and impaired insulin production, either of which may predominate. It is most common among people aged 40 years or over, and early diagnosis and treatment increases the possibility of management through lifestyle modification and/or medication (Dunstan et al. 2001). The evidence suggests that two modifiable risk factors, obesity and physical inactivity, are the most important contributors to the development of Type 2 diabetes and should be the focus of preventive strategies (Costacou & Mayer-Davis 2003; Mensink et al. 2003; National Health and Medical Research Council 2001). A healthy lifestyle forms the basis for a management plan for diabetes patients. More exercise can decrease risks such as central obesity, low cardiovascular-protective high-density lipoprotein cholesterol, and abnormal triglycerides (Simpson et al., 2002; Kain et al 2003, cited in Hill 2006). A healthy, regular eating pattern, regular physical activity, the cessation of health-damaging behaviours, such as smoking, and an annual review of diabetes control are recommended for all patients with diabetes. The UK Prospective Diabetes Study Group (UKPDS 1998), in a large multicentre trial investigating Type 2 diabetes, established that control of glycaemia and blood pressure significantly reduced the risk of microvascular and macrovascular complications (Hill 2006). The best treatment strategy is prevention by maintaining good control of blood glucose.

Diabetic nephropathy is of increasing concern in Insulin-Dependent Diabetes Mellitus and Non-Insulin-Dependent Diabetes Mellitus. One study found the prevalence rate of Diabetic nephropathy in Type 2 diabetes was 21% in patients with more than a 22-years history of diabetes, followed by a decline to 10% after 40 years (Fu 1997). The prevalence of diabetic nephropathy in Type 2 diabetes in that study was 16% in European countries, being 5% in the

first year after onset, and increasing steadily with duration of diabetes to a rate of 35% in those with diabetes for more than 20 years. The research found that microalbuminuria in Type 2 diabetes was associated with disease progression to ESRF while it was associated with progression to overt diabetic nephropathy, higher mortality, hypertension and macroangiopathy in Type 2 diabetes. The risk factors of diabetes nephropathy were found to be duration of diabetes, hyperglycemia, smoking, hypertension, frequent urinary tract infection, age, genetic factor, dietary protein, and hyperlipidemia. In the prevention of microvascular disease, good control of diabetes is the most effective intervention. Cardiovascular risk factors are also crucial (Fu 1997). Similarly, the Chang et al. (2000) study showed insulin treatment and glycemic control consistently correlated with nephropathy and neuropathy.

Concordance with medication and blood glucose monitoring is also important, although many patients regularly miss insulin and tablets, or perform an insufficient number of blood glucose tests to manage their condition effectively (Morris et al 1997, cited in Hill 2006). Self-management skills and patient empowerment are therefore essential for the successful control of diabetes (Hill 2006).

The Connor et al. (2003) study showed that the importance of dietary management to minimise obesity and cardiovascular risk in South Asian persons with diabetes is no different from that of non-Asian persons (Connor et al. 2003, cited in Hill 2006). However, it is important to ensure that advice and information are culturally sensitive and to recognise the importance of food in the social context (Ikeda 2004, cited in Hill 2006). Food is an important part of social life, and the associated cultural significance of food has the potential to impact on diet adherence. This is especially the case in Asian cultures where food forms an important part of the total cultural experience; therefore a 'diabetes diet' may mean isolation from the social/cultural group. In some cases, this has meant that people with diabetes have felt they could not eat with their

family or join in special social events and cultural events (Hill 2006). This has important implications for the management of people with diabetes. Education providers must ensure they target their clientele appropriately taking all such issues into account. Factors such as language barriers, lifestyle factors and family matters must all be addressed if interventions are to succeed. When designing activity interventions it is also important to ensure that the program is both culturally safe and conducted in an appropriate environment (Hill 2006).

Treatment of Type 2 diabetes changes over time. Interventions to improve insulin sensitivity are initially instigated, such as weight loss if the patient is overweight, and increased physical activity, if the person is leading a sedentary lifestyle. The next stage of treatment involves the administration of oral hypoglycaemic agents that stimulate beta cell function, such as sulphonylureas, and prandial glucose regulators, for example, repaglinide and nateglinide. If the condition progresses to beta cell failure, insulin addition therapy is required (National Institute for Clinical Excellence 2002, cited in Hill 2006). The treatment goals for the management of both Type 1 and 2 diabetes include blood pressure <130/80mmHg, low-density lipoprotein (LDL) <2.6mmol/L, triglycerides < 1.7mmol/L and high-density lipoprotein >1.1 mmol/L. Those people with known cardiovascular disease, a strong family history of cardiovascular disease, known risk and aged more than 40 years, are usually prescribed low-dose aspirin therapy (Cohen & Shaw 2007).

In addition, Type 2 diabetes is largely preventable. Diabetes risk factors include socio-environmental risk factors (such as poor socioeconomic circumstances), psychosocial risk factors such as social isolation and lack of social support, behavioural risk factors such as physical inactivity and poor nutrition, including high dietary intake of energy dense foods particularly fats and low fruit and vegetable consumption, and physiological risk factors such as obesity, impaired glucose tolerance sometimes called pre-diabetes. Pre-diabetes is where the condition may progress to diabetes but can be effectively managed through weight reduction

and physical activity. Gestational diabetes is diabetes associated with pregnancy which may increase the risk of Type 2 diabetes developing later in life for both mother and baby (National Health and Medical Research Council 2001). Many of these risk factors and conditions are potentially modifiable, and provide opportunities for prevention. However, diabetes prevention relies on identifying at-risk groups and providing a potent and cost-effective intervention (Cohen & Shaw 2007). This can be challenging given the large numbers of people at risk and the variety of issues that need to be addressed in interventions.

The recent guidelines from the National Institute for Health and Clinical Excellence recommend that all patients with diabetes should have the opportunity to attend a structured education programme (Parken & Sturt, 2009). However, a report on diabetes services in South Asian communities in the United Kingdom (UK), conducted in the late 1990s by the Audit Commission showed that patient education is inadequate in many areas of primary, secondary and tertiary care (Hill, 2006). High quality structured education sessions are required if the management of Type 2 diabetes is to be effective. Educational and behavioural interventions for Type 2 diabetes have demonstrated modest improvements in glycemic control but there is a need for interventions that support and encourage long term changes (Wangberg 2008).

The Yang et al. (2001) study showed that effective blood pressure control, intensive glycemic control, and use of angiotensin converting enzyme inhibitors in diabetic patients significantly reduced of the rate of progressive renal failure and also substantially reduced the cost of complications. It also led to higher cost-effectiveness. Once diabetic patients reach the stage of ESRD, Yang et al. (2001) recommended an optimized pre-ESRD care and consideration of kidney transplantation are essential in terms of better patient survival and cost savings.

1.1-6 Taiwanese setting

There are approximately 23 million Taiwanese living in Taiwan. From 1951 to 2005, the life expectancies for women and men rose from 56 to 79.8 years and 53 to 73.7 years respectively (DOH 2005). Taiwan has become an aging society since 1993, where its older population, compared to the percentage of nationwide population, has risen from 7.1% to 10.2% within the last 15 years (Wu, 2009). However, this is not only occurring in Taiwan but the same aging-population trend is now common in many western countries (Chang 2005).

In 2005, the five leading causes of death in Taiwan were: 1.malignant neoplasm, 2.cerebrovascular disease, 3. heart disease, 4. diabetes mellitus, 5. trauma (DOH, 2006). Of these, diabetes is the most rapidly increasing disease in Taiwan (Chang 2005). World-wide, older adults constitute about one-half of the diabetic population. In this age group diabetes is a serious disease linked to a higher mortality rate and shorter life expectancy, mostly due to increased atherosclerotic complications (Wandell & Tovi 2000).

As a result of an aging population combined with the increase in chronic diseases, the Taiwanese government is following the guidelines of the World Health Organization (WHO) and increasingly focusing their efforts on promoting healthy lifestyles across the life span. In 2000 the Department of Health (DOH) addressed the National Health Promotion Plan and activated the goals for enhancing the health of the populace through health promotion, health maintenance, and health care services (Wu 2002).

There are at least three reasons why health promotion is important for the older citizens of Taiwan. These reasons are: (1) older adults are the fastest growing segment of the population; (2) high incidence and prevalence rates of chronic diseases are associated with aging, and (3) older adults are likely to require and consume the high cost of long-term care (DOH 1999). Cid et al. (2006), in a study of 360 Taiwanese persons aged from 15 to 64 years, free from chronic

diseases, found that only half of the studied sample were engaging in a healthy lifestyle. Similarly, Wang and Liu (2001) pointed out that only 40 % of people with diabetes in Taiwan had appropriate exercise behaviours. Even though people with diabetes were aware of the advantages of good glycemic control, only 20% of community-dwelling persons with diabetes in Taiwan actually accomplished that goal (Chang & Lin 2000). Ruffing-Rahal (1991, cited in Wang 1991) identified the fundamental goal of health promotion as the achievement of well-being in older adults on an ongoing basis. Although older adults may suffer from chronic diseases, cognitive impairment, and functional limitations, choosing a healthy lifestyle can minimize health problems and lead to enhanced health outcomes. Ruffing-Rahal (1991) outlined five reasons for health promotion in older adults: most older adults believe themselves to be active and in good health condition despite the presence of chronic diseases and disabilities; older adults are motivated to learn about aging and health conditions; older adults can be transformed into knowledgeable participants and managers of their own self-care by using health promoting strategies; health promotion can facilitate older adults' living independently; and health promotion for older adults can diminish morbidity and impairment. Health promotion for older adults, therefore, was considered as "an intervention with important payoffs in terms of both cost saving and quality of life" (p.258). Therefore, encouraging self-management education is pivotal for the care of all elderly people with diabetes in Taiwan in order to improve health outcomes. Diabetes self-management education (DSME) is the ongoing process of facilitating the knowledge, skill and ability required for diabetes self-care. The guiding principles of DSME include the following: (1) Diabetes education is effective for improving clinical outcomes and quality of life; (2) DSME has evolved from primarily didactic presentations to more theoretically based empowerment models; (3) There is no “best” education program or approach; however, programs that include behavioural and psychosocial strategies demonstrate better outcomes. It has also been shown that culturally and age appropriate programs improve

outcomes and group education is also effective; (4) Ongoing support is critical to maintain improvement in participants; and, (5) Behavioural goal-setting is an effective way to support self-management behaviours (Bodenheimer, MacGregor & Sharifi 2005).

1.1-7 Diabetes mellitus in Taiwan

Diabetes mellitus Type 2 has become a major health problem in the developed world. Epidemiological studies have indicated that the prevalence of this disease in older adults is increasing in Taiwan at alarming rates. Over the past 30 years, Taiwan has experienced a rapid change in many aspects of lifestyle and dietary habits. This is linked to an increasing prevalence of chronic diseases, including cerebral and cardiovascular disease and diabetes mellitus (Lin & Lee 1992). The highest rates of increasing incidence of diabetes is anticipated to be in the Asia region (Chan, Ng, Critchley, Lee, & Cockram 2001). Tseng et al. (2006) showed an increasing prevalence of Type 2 diabetes in Taiwan. Their study, undertaken to assess the yearly incidence for Taiwan during 1992-1996, from a sample of 93,484 diagnosed diabetic patients enrolled in Taiwan's National Health Insurance programme, found the overall 5-year incidence for men and women was 187.1 and 218.4 per 100,000 populations, respectively. In addition, it is calculated that Type 2 diabetes mellitus affects over 900,000 people in Taiwan and every year over 379,600 new cases are identified (Lin et al. 2002).

The Department of Health in Taiwan (1996, cited in Lu, Yang, Wu, Wu, & Chang 1998) stated that in Taiwan, the mortality rate associated with diabetes mellitus had almost doubled over the past 10 years. The National Health Department, Taiwan (1977, 2000, cited in Lin, Shiau, Li, Kao, & Lee 2002) reported that “there was an increasing trend of crude death rates of diabetes mellitus for aged males (from 118.7 to 454.2 per 100,000) and females (from 66.7 to 310.1) between 1977 and 2000 in Taiwan”. This is useful as it does show a trend of increasing morbidity from diabetes. Most of these studies were conducted to identify risk factors for Type

2 diabetes mellitus, including cerebrovascular disease and heart disease, which in 2002 were the second and third leading causes of death in Taiwan respectively (DOH 2003). A national survey reported that in 2007 diabetes mellitus was the fourth highest cause of death in Taiwan (National Health Department 2008).

In addition to the health impact on individuals, diabetes also significantly increases the national medical expenditure. In 1998, diabetes accounted for 1 in every 4 hospital beds and 1 in every 16 health clinic visits (1/4 for diabetes care an 3/4 for care of its complications) (National Health Insurance Bureau, Taiwan, 1998, cited in Lin, Shiau et al. 2002). Wei et al (2002), in a study of the prevalence and hospitalization rates of diabetes in Taiwan, from 1996 to 2000, found the prevalence rates of diabetes increased from 0.4-1.2% for the population aged less than 10 years, to 129-210% for the population aged 70 years and above. The overall annual age-standardized prevalence rates ranged between 29-37% for males and 38-46% for females. Among those with diabetes, 18.6-20.0% of male patients and 16.5-17.8% of female patients experienced at least one hospitalization annually. As the prevalence of diabetes for all ages in Taiwan is in increasing trend and the annual hospitalization rates among those with diabetes remained at the same high levels, the researchers estimated that all persons with diabetes in Taiwan consume the same amount of medical expenditure as 3,870,000 individuals without diabetes (Lin, Chang et al. 2002). The social and economic burden of diabetes is obviously very high due to the serious complications associated with the disease.

Chou, Tung, Li, Chuang, Lin and Yang (2002) studied the epidemiology of diabetes mellitus in Taiwan. Those with poor blood glucose control were found to have sequential complications, including macro-vascular disease (CVD), micro-vascular disease (retinopathy and nephropathy), and neuropathy. Studies have also shown that different areas have different rates of diabetic complications. According to Chou et al. (2002), the diabetic complications rates account for: (1)

Micro-vascular disease comprising diabetic retinopathy of between 20 % to 45%; stroke between 2.5 to 6%; 1.7% leg vessel disease and protein urine 17% to 24%; (2) Diabetic peripheral neuropathy about 11% to 32%; (3) Macro-vascular disease (CVD) including IHD 15%; arterial insufficiency 12.6%; medical arterial calcification 13.6% and cataract 38%. (Chou et al. 2002).

Lee et al. (2006) explained that diabetes is often associated with complications and co-morbidities. Their study was undertaken to compare medical resources used by patients with the following diagnoses: diabetes mellitus (DM), diabetic neuropathy (DN), and diabetes mellitus combined with comorbid depression (DD). There were 55,972 patients in the DM cohort, 2,146 in the DN, and 2,379 in the DD of adults. Results indicated significant differences in demographic characteristics, comorbidities, and medication use among individuals diagnosed with DM, DN, or DD. These differences translated into significant cost differences. Patients diagnosed with DN or DD had higher diabetes-related costs than patients diagnosed with DM.

Yoon et al. (2006) identified that childhood obesity has increased substantially and the prevalence of Type 2 diabetes has now reached epidemic levels in Asia. The health consequences of this epidemic threaten to overwhelm health-care systems in the region. Urgent action is needed, and advocacy for lifestyle changes is the first step. Countries should review and implement interventions, and take a comprehensive and integrated public-health approach. At the level of primary prevention, such programmes can be linked to other non-communicable disease prevention programmes that target lifestyle-related issues.

Table 1: The rates of complications of patients with Type 2 Diabetes Mellitus in Taiwan.

Study	Study's characteristics	Study's findings and conclusion
1.microvascular complications: retinopathy or vision disorders (glaucoma, cataract and corneal disease), nephropathy (kidney disease) and neuropathy (nerve damage).		
Chen, Kao, Jen, Wu, Fu, Chen & Tai(1994)	*11478 subjects aged 40 years or older were screened for diabetes in one urban and five rural areas. Among the 715 subjects proven to have diabetes, 527 subjects underwent ophthalmoscope	*Diabetic retinopathy was present in 184 of the 527 subjects (35%) *Duration of diabetes was the most important risk factor related to retinopathy *Diabetic retinopathy has now become a major cause of loss in visual acuity in adults.
Chang, Fu, Chen et al (1990)	* A comparison of newly and previously diagnosed diabetics in Taiwan	*The Diabetic retinopathy was present in newly and previously diagnosed diabetics patients were 28.3% and 45.2%, separately.
Jiang, Chuang, Wu, Tai & Lin (1998)	*Hospital-based surveyed outpatient clinic for screening of chronic diabetic complications	* Diabetic retinopathy was present 42.4% and micro-protein urine 24%

Table 1 (continued): The rates of complications of patients with Type 2 Diabetes Mellitus in Taiwan.

Study	Study's characteristics	Study's findings and conclusion
Chen, Kao, Fu, Chen & Tai(1995)	* A 4-year follow-up for incidence and progression of diabetic retinopathy among Type 2 diabetic subjects	* Diabetic retinopathy was present 19.2%
Chuang, Tsai, Huang & THE DIABBCARE(Taiwan) Study Group (2001)	* A cohort of 2446 patients (from 25 diabetic centres) with more than 12 months of diabetes management participated and data were collected by interviewed and reviewing the medical records 1998. Overall, 97% were diagnosed as Type 2 diabetes, with a mean age (± S.D.) of 61.6± 11.3 years, duration of diabetes of 10.3± 7.3 years	*Of all the patients who had screening for complications, cataract (38%), neuropathy (30%), protein urine (17%) and stroke (6%) were the most frequently reported eye, feet, kidney and late complications.
※Chang, Lu, Yang, Wu, Wu, Chen, Chuang, Tai, (2000)	The prevalence of DM in Taiwan was established between 1985 and 1996	*The diabetics had a significantly higher prevalence of macrovascular disease than non-diabetic subjects. *The most significantly associated with the large vessel disease was serum cholesterol levels. Serum cholesterol and HbA1(c) were significantly associated with the development of ischemic heart disease. *Cigarette smoking and female gender were significantly associated with the leg vessel disease.

Table 1 (continued): The rates of complications of patients with Type 2 Diabetes Mellitus in Taiwan.

Study	Study's characteristics	Study's findings and conclusion
2. Macrovascular complications: ischaemic heart disease, cerebrovascular disease and peripheral vascular diseases which can lead to ulcers, gangrene and amputations.		
Chen, Hwu, Kuo, Chiang, Kwok, Lee , Lee, Weih, Hsiao, Lin & Ho (2001)	*Between 1989 and 1993, 431 men and 181 women with Type 2 diabetes were given diabetic autonomic neuropathy cardiovascular reflex (CVR) tests.	*The 8-year survival rate for patients with abnormal CVR tests was 63.6% in males and 76.4% in females. * Type 2 diabetic patients with abnormal CVR tests may have increased morality.
※Lo(2007)	A cross-sectional epidemiology study of subjects aged 40-65 years, with Type 2 DM more then three years. A total of 104 subjects (57 men and 47 women) completed the questionnaire.	*intake of anti-oxidative vitamins below recommendation may increase the risk to develop cardiovascular complications. * Intake of anti-oxidative vitamins in Type 2 DM patients is well above the recommendation for healthy subjects.

Table 1 (continued): The rates of complications of patients with Type 2 Diabetes Mellitus in Taiwan.

Study	**Study's characteristics**	**Study's findings and conclusion**
Lo(2007) - continued		* in order to prevent thrombogenic complications, intake of vitamin C and vitamin E supplements may have beneficial effects to Type 2 DM patients.
Wang, Wang, Lin, Chien, Huang & Lee (2000)	*219 (71%) of those patients were compared to 100 individuals randomly selected for the non-diabetic control group in the same community, in Chin-Shan, Taipei	*Diabetic patients had significantly higher prevalence of peripheral neuropathy (32.4% vs 16%), arterial insufficiency (12.6% vs 3.0%), and medical arterial calcification (13.6% vs 5.0%), when compared to the non-diabetic controls.
Fu, et al (1993)	* A 4-year follow-up study of diabetic patients between 1985 to 1986 in Northern Taiwan	*Diabetic patients have 15% ischemic heart disease, 1.7% leg vessel disease and 2.5% stroke *Cholesterol is a significantly risk factor for macro-vascular disease (CVD) *Cholesterol and HbA1c have a significantly related to IHD *smoking and females have higher risk rate for leg vessel disease

Table 1 (continued): The rates of complications of patients with Type 2 Diabetes Mellitus in Taiwan.

Study	Study's characteristics	Study's findings and conclusion
Fu, et al (1993) (continued)		*smoking and females have higher risk rate for leg vessel disease
※ Chen (2005)	The research subjects were at the ages from 35 to 81 years old. The experimental group will receive a foot care program.	*In Taiwan, the diabetes mortality rate had increased from 25.7/106 in 1993 up to 44.4/106 in 2003, the highest was at Hualien as 74.5/106. Ulceration and amputation on lower extremity limbs are common complications in diabetes. * foot-care educational program was effective in promoting the knowledge, self-efficacy and behaviors of self-care for aborigine with diabetes.
Fuh (2006)	To compare the efficacy and compliancy between Western medicine and Traditional Chinese medicine in the treatment of diabetes in Taiwan. .	It is worthwhile to further analyze the other confounding factors dealing with the lower incidence rate of hypertension in the study group such as physical activity, smoking habitudes and even herb medications.

Table 1 (continued): The rates of complications of patients with Type 2 Diabetes Mellitus in Taiwan.

Study	**Study's characteristics**	**Study's findings and conclusion**
3. Other:infections, metabolic, impotence, autonomic, neuropathy, hip fracture, problems of pregnancy ※ Chen et al.(2008)	Diabetic patients (*n* = 500,868) and an age- and sex-matched control group (*n* = 500,248) were linked to inpatient claims (1997–2002) to identify hospitalizations for nontransport accident hip fracture	In Taiwan, diabetes increased the risk of hip fracture in both sexes in all age-groups except in diabetic men aged >74 years and diabetic women aged >84 years. Higher Hazard ratios (HRs) of hip fracture were disproportionately observed in younger diabetic patients and in those living in rural areas.

1.1-8 Ethnic groups of Taiwan

In addition to the Aborigines who are indigenous and usually live in remote mountain areas, in general there are three other main ethnic groups in Taiwan based on different times and the location of immigration from mainland China. These three ethnic groups are Mainlanders, Ho-Lo, and Hakka people. From a cultural perspective, different ethnic groups may have different "thinking, decisions, and actions in patterned ways" (Leininger 1985, p. 209). In considering the design of effective intervention programs, therefore, community nurses cannot neglect ethnicity, if they are to understand their clients, especially the elderly (Wang 1999).

Despite the significance of health promotion in older adults, very little health promotion research has focused on Taiwan's Aboriginal population (Wang & Hsu 1997 cited in Wang 1999). Moreover, none of the previous studies on diabetes in Taiwan explored or examined health promotion in the different ethnic groups. Two possible explanations for this lack of research should be considered. One explanation might be that the researchers did not consider

ethnicity to be an important factor in influencing an individual's behaviors. Secondly, as older people are more likely to speak their mother tongues (dialects) than the official language of Taiwan (Mandarin), this group may have been considered too difficult to include in research. Language barriers are known to affect learning and hinder research; hence this group may have been excluded on that basis. Further, people who live in rural areas usually use their mother tongues to communicate and might obtain only limited diabetes information from television and newspapers and may also have been unaware of the studies. However, consideration of rural areas as research settings is critical to the discovery of the related health behaviors of diverse ethnic groups with different spoken languages.

1.2 The present study

In light of the above information, there is a need for further research into medical education for Taiwanese Aboriginal and non-Aboriginal patients. This was the prevailing motivation for the present study which investigated Type 2 diabetes in Taiwanese Aboriginal and non-Aboriginal elderly patients. Type 2 diabetes was chosen as the study's focus for the following reasons:

1. In Taiwan, about 10% of the elderly population is affected by diabetes (known and new cases of diabetes).
2. There is a high risk of developing chronic complications for diabetic patients, including neurological, cardiovascular and renal problems.
3. Increasing diabetes incidence and prevalence has a significant economical impact in Taiwan (Chou, Li, Kuo, Hsiao, & Tsai 1997).
4. With decreasing mortality rates and a desire to increase the quality of life of elderly Taiwanese, a healthy lifestyle is important.

The aim of this study is to investigate the effects of an educational intervention program on Taiwanese Aboriginal and non-Aboriginal elderly with Type 2 diabetes mellitus.

Research Hypotheses

Major Hypotheses:

1. A specially designed health care package will have a significant effect on Aboriginal and non-Aboriginal older adults patients with Type 2 diabetes in Taiwan. It is hypothesized that the percentage of patients with well controlled blood glucose levels will increase from about 60% to 80% because of the delivery of the health care package.
2. A health care package will encourage lifestyle change for Taiwanese Aboriginal and non-Aboriginal older adults with Type 2 diabetes and will therefore decrease their markers for diabetic complications from 50% to 30%. Markers for diabetic complications considered were: (1) Micro-vascular disease including diabetic retinopathy, cataract, and stroke, leg vessel disease, and protein urine; (2) Diabetic peripheral neuropathy; (3) Macro-vascular disease that includes ischemic heart disease, arterial insufficiency, and medical arterial calcification.

Secondary Hypotheses:

1. A health care package will result in an increase in exercise, healthy diet choices and better blood glucose management and will therefore lead to a better overall quality of life.
2. The different cultural aspects and lifestyles of Aboriginal and non-Aboriginal older adults with Type 2 diabetes will affect their disease perception.

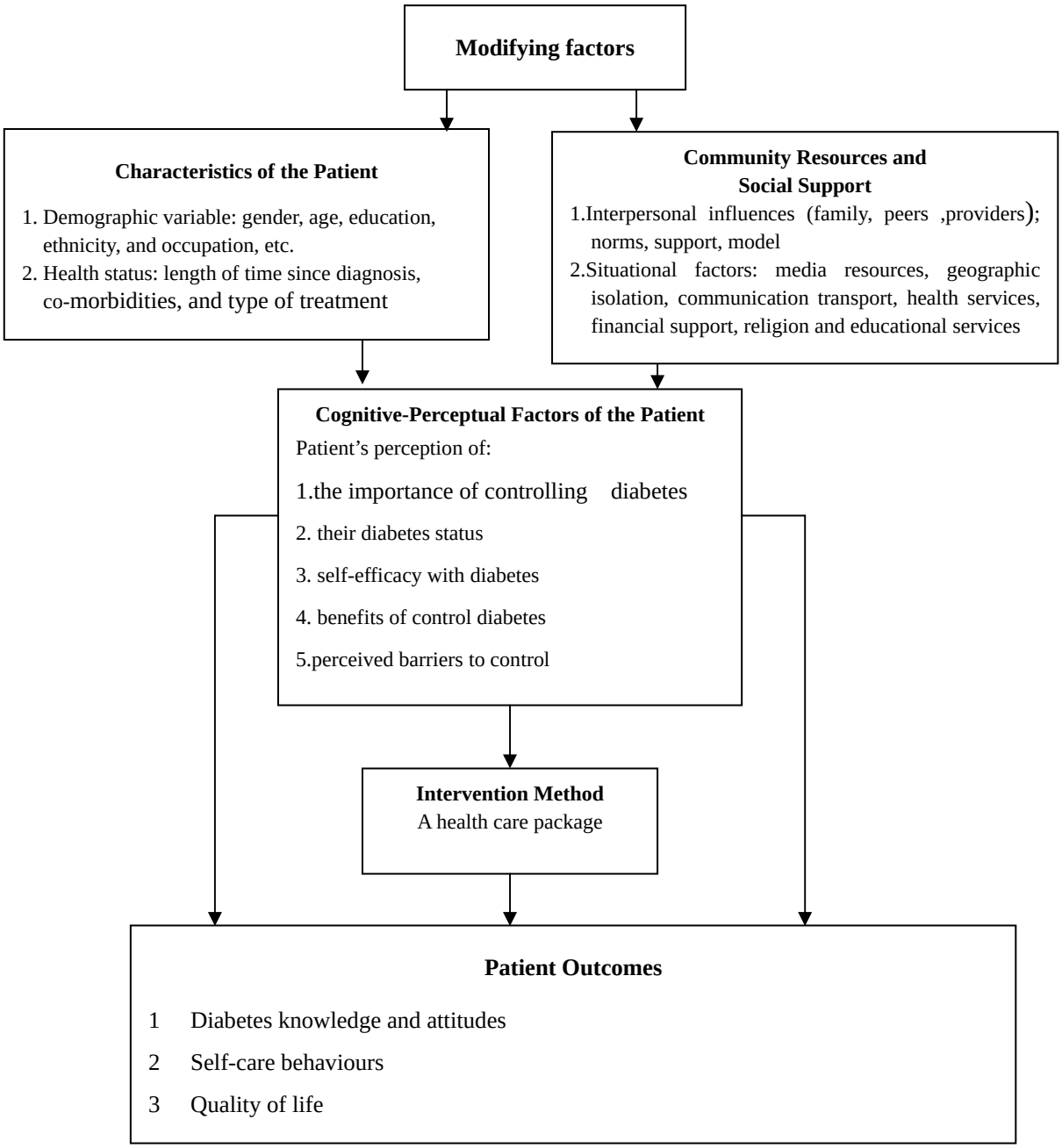
1.3 Theoretical Model - The Health Education Model

The Health Education Model (HEM) utilized was based on the Revised Pender Health Promotion Model (RHPM) (Pender 2006). Pender (1987) identified health promotion as "directed toward increasing the level of well-being and self-actualization of a given individual or group" and stated that "health promotion focuses on movement toward a positively balanced state of enhanced health and well-being" (p57). The Health Education Model was developed

and used to manage Type 2 diabetes based on a systematic group education approach, aimed at sustained body weight reduction, decline in cholesterol, and stabilization of HbA1c. HbA1c indicates the possible level of glucose damage to tissues, and most diabetic individuals have a higher HbA1c average level than non-diabetics. Five major components of the HEM were included in the devised intervention program: characteristics of the patient, community resources and social support, cognitive-perceptual factors, intervention method, and patient outcomes. The characteristics of the patients include demographic variables such as health status and lifestyle. Community resources and social support factors include interpersonal influences such as family and peer group supports, as well as situational factors such as, media resources, geographic isolation, communication, transport, health services, financial support, and educational services. The cognitive-perceptual factors of the patients include the patient's perception of the following: (i) The importance of controlling diabetes; (ii) The definition of Type 2 diabetes; (iii) Their diabetes status; (iv) Self-efficacy with diabetes; (v) Perceived benefits of control of diabetes; and, (vi) Perceived barriers to glycemic control. Within this framework, the intervention method of 'group health education' acknowledges the structure and process of these inter-relationships and collaboration is seen as a function of patient characteristics, community resources and social support, patient cognitive-perceptual factors, and intervention methods; these factors will ultimately affect patient outcomes. The aim of the diabetes education was to increase awareness of the link between good glycemic control and the coordination of diet, exercise, and medication. Finally, participant outcome measures considered were general self-care, including diabetes knowledge and attitudes, self-care behaviours, and quality of life. In addition, patient outcomes will be used as feedback to affect patient perception. These two components are proposed to be related to patient perception - such as characteristics, community resources and social support. The effectiveness of community resources and social support efforts is assessed by families, friend support systems, and successful community

services such as multiple media resources, convenient transport, health services, financial support, and educational services.

Figure 1: Framework of Health Education Model for Type 2 Diabetes adapted from Pender's Health Promotion Model (Pender, 2006, p.50)



Theoretical Explanations

Patient Characteristics linked to Patient's Cognitive-Perceptual Factors

The characteristics of the patient are an essential factor that must be considered when developing and delivering health education as it may affect the perceptions of the patients. A study by Alexandris and Carroll (1997) aimed to investigate demographic differences (age, gender, education and marital status) in the perception of constraints on recreational sport participation in Greece. The results indicated that: (a) Females were significantly more constrained than males, especially by intrapersonal constraints; (b) The perception of constraints significantly increased among less-educated individuals; (c) There was an inverted U-relationship between perception of constraints and age; (d) Married individuals were significantly more constrained than single persons on time-related constraints (Alexandris & Carroll 1997). In addition, research that measured the health perceptions of older diabetic patients of endocrinologists found they had a higher utilization of diabetes-specific processes of care measures and had a similar functional status despite having more diabetic complications. However, they received a more costly style of care than patients of family practitioners and general practitioners.

Tang and Chen's (2002) study explored the relationship between and among the caregiver's personal factors, the care recipient's functional status, the caregiver's perceived self-efficacy, social support, reactions to care giving, and health promotion behaviors in family caregivers of community-dwelling stroke patients in Taiwan. The results revealed that the caregiver's health status was the strongest positive predictor of caregiver self-efficacy. Spousal caregivers with a better-perceived health status were more satisfied with their resources of social supports. Spousal caregivers with poor perceived health status had a higher level of care giving nervous tension. Results for the overall model indicated a caregiver's social support and the care

recipient's functional status made significant contributions in explaining the caregiver's health promotion behaviors.

The study by McDonald and co-workers (2002) explored relationships among personal factors, mental health, and physical functioning on social support, social support on acceptance and health-promoting behaviors and health-promoting behaviors on HbA1c. Face-to-face interviews were conducted using a convenience sample of 63 African-Americans from a community clinic. Their results found physical functioning was the only significant predictor of social support. Subsequently, social support was argued to have predicted acceptance and health behaviors. Other authors found similar results. For example, Callaghan (2006) investigated the relationships among health-promoting self-care behaviors, self-care self-efficacy, and self-care agency in a 379 adult population. The results showed statistically significant relationships were found between the following basic conditioning factors and the study variables: age, gender, income, marital status, education, race, and routine practice of religion. Heisler et al. (2003) conducted an observational study of 801 white and 115 black patients who completed the Diabetes Quality Improvement Project survey (response rate = 72%) in 21 Veterans Affairs (VA) facilities in the United States using survey data and medical record information on receipt of diabetes services. They found racial disparities in some diabetes care processes and intermediate outcome quality measures, but not in intensity of treatment for those patients with poor control. Disparities in regard to receipt of eye examinations were the result of black patients being more likely to receive care at lower-performing facilities, whereas for other quality measures, racial disparities within facilities were substantial. Taechaboonsermsak and colleagues (2005) used Pender’s Health Promotion Model to examine the causal relationships among age, education, family income, and stage of carcinoma, perceived benefits, perceived barriers, perceived self-efficacy, health promoting behavior and quality of life with 488 cervical cancer patients in Thailand. The results demonstrated that health promoting behavior had a significant direct

positive effect on quality of life. Cognitive perceptual factors had a significant direct effect on health promoting behaviors; social support had a significant direct effect on the cognitive perceptual factors, health promoting behavior and the quality of life. Age and education did not have a significant total effect on the quality of life while family income had a significant direct effect on cognitive perceptual factors. The direct effect of the predictors on the quality of life indicated that cervical cancer patients with a higher practice of health promoting behavior tended to have a higher quality of life. These findings were said to indicate that Pender's Health Promotion Model is a useful guide for explaining and predicting the health promoting behavior and the quality of life of Thai cervical cancer patients who were undergoing radiotherapy. The significance of cognitive perceptual factors and social support confirm health promoting behavior as a goal directed towards the level of well being.

Community Resources and Social support linked to Patient's Cognitive-Perceptual Factors and Outcomes

Griffith and colleagues (1990) argue that during stressful times social support may insulate patients with diabetes from the adverse physiologic and behavioral consequences of stress thereby fostering better glucose control. Mahon et al. (1998) examined 70 young adults who were attending classes in a large urban university. The results indicated that loneliness is a dominant mediator in the relationship between perceived social support and positive health practice.

Callaghan (2006) investigated the relationships among health-promoting self-care behaviors, self-care self-efficacy, and self-care agency in an older adult population. The conclusion was that spiritual growth influences older adults' self-care agency to a greater extent than self-care self-efficacy.

In addition, it has also been argued that knowledge of the family function, affect, locus of control, perceived stress, and coping strategies may be useful to the family physician in the care

of adults with diabetes mellitus, since these psychosocial parameters are associated with objective and perceived glycemic control (Konen et al. 1993). They suggested community health nurses must be aware that this population may have needs that are unsatisfactorily met. They should provide education and resources for support persons and carefully evaluate the support network, not only for availability, but also for satisfaction. Effort should also be directed toward developing alternative support for those without available family (Konen et al. 1993).

Many reports have shown that social support and self care behaviors are strongly associated with health-related outcomes. For example, the Gielen et al. (2001) study described the relationship between psychosocial factors and health related quality of life among 287 HIV-positive women using items from the Medical Outcomes Study HIV Health Survey that measures physical functioning, mental health and overall quality of life. The results indicated that modifiable factors such as social support and self care behaviors are strongly associated with health-related quality of life and suggests a new opportunity for improving the lives of women living with HIV. Other authors also report similar results. Nunes et al. (1995), for example, examined the relationship between social support and quality of life in individuals with HIV. The findings of the study indicate that social support and quality of life are significantly interrelated.

Chlebowy and Garvin (2006) investigated the relationships of psychosocial variables such as social support, self-efficacy, and outcome expectations to diabetes self-care behaviors and glycemic control in Caucasian and African American adults with Type 2 diabetes from outpatient visits at 1 of 3 clinical sites in the southeastern United States. All 91 participants completed 4 self-report measures. The data results showed self-care behaviors were significantly, positively correlated with outcome expectancy scores for the total group and for

African Americans particularly. Sammarco's (2001) research investigated the relationship between perceived social support, uncertainty, and quality of life among younger breast cancer survivors. The findings revealed a significant positive correlation between support and network size, and between network size and the socioeconomic domain of quality of life. Sammarco's (2001) study clearly shows social support as an important factor in cancer survivor's quality of life.

Patient's Cognitive-Perceptual factors contributing to Patient Outcomes

Navuluri (2001) pointed out that several variables such as knowledge, beliefs, attitudes, self-efficacy, and problem-solving capabilities influence health behaviors associated with lifestyle change (Whittemore 2000, cited in Navuluri 2001). Additionally, individuals differ in their perception of a stressful event, and the way a person appraises an encounter determines how that person will cope with such stress (Lazarus & Folkman, 1984 cited in Navuluri 2001). Kobasa (1979, cited in Navuluri 2001) suggested that the personality resource of hardiness may have a direct effect on a person's ability to cope with stress. Later, Pollock (1984 cited in Navuluri, 2001) developed the concept of health-related hardiness while studying the adaptation response of individuals to chronic illnesses such as diabetes mellitus, hypertension, and rheumatoid arthritis. Health-related hardiness is a personality resource comprising of (a) The commitment dimension, which represents the appraisal and coping strategies an individual used in adaptation to chronic illness; (b) The control dimension, which represents the use of ego resources necessary to appraise, interpret, and respond to health stressors; and (c) The challenge domain, which represents the reappraisal of the health stressors as potentially beneficial or rewarding rather than threatening or harmful (Pollock 1986 cited in Navuluri 2001).

Other research identified patient's self-perception as being related to patient outcomes. For example, on the basis of a literature review and Pender's health promotion model (HPM), Han et

al. (2005) designed a structural model to represent the quality of life of 436 patients with cardio/cerebrovascular disease (CCVD). The result found Health-promoting behavior (HPB) and self-efficacy having a significant direct effect on quality of life. Health perception, self-esteem, perceived barriers to action, and preference were found to have indirect effects on QOL.

Duffy's (1993) study, to determine the degree to which selected components derived from Pender's Health Promotion Model (1982), explained engaging in health promotion practices in a sample of 477 persons 65 years and older. The result showed older healthy persons with high self-esteem and internal locus of control reported practicing five of the six health promotion strategies. Older married subjects with higher incomes who were internally controlled were more likely to engage in exercise, health responsibility and stress management but not in interpersonal support. Findings provide direct multivariate support for the additive nature of the relationships posited in the Health Promotion Model. Shin et al. (2005) tested seven constructs from the health promotion model (HPM) as a causal model of commitment to a plan for exercise in a sample of 400 Korean adults with chronic disease. They suggested health professionals can assess prior experience and emphasize personal relevant benefits of exercise in designing intervention programmes to help people with chronic disease become more physically active. McNicholas (2002) examined the relationships between positive health practices and social support, self-esteem, and optimism. From the results, social support, self-esteem, and optimism were all positively related to positive health practices, and social support was positively related to self-esteem and optimism. Smith and Bashore (2006) used Pender's revised health promotion model to conduct a study investigating the perceived health status and health-promoting behaviors of adolescent/young adult cancer survivors. The data analysis indicated perceived health status is positively related to health education.

Research conducted by Watkins and co-workers (2000) involved secondary analysis of a mailed survey completed by 296 adults. Structural equation modeling was conducted to investigate relationships among cognitive representations, diabetes-specific health behaviors, and quality of life. Their findings advanced what is known about cognitive representations of illness and the self-regulation of diabetes as well as the relationships between cognitive representations of illness, quality of life, and behavioral factors.

Intervention Method: a health care package of Type 2 diabetes contributing to Patient Outcomes

Clinical outcomes in diabetes are as dependent on psychosocial factors or learned behaviour as well as on metabolic state and therapeutic interventions. These factors include targets set, self-management skills, influence of living with diabetes, emotional factors, role of other people, perceived benefits and barriers, feelings of self-efficacy, weight concern and diet barrier. Training in learning processes and factors governing behaviour are essential for all those involved in delivery of patient care. Thus educational programmes should recognize the wide range of learning strategies used by different people (Day 2000). Further, Van den Arend and colleagues (2000), identified that the success of diabetes education interventions on behavioral change may be enhanced if the patients are involved in the planning of the educational approach and content. The improvements in the Van den Arend (2000) study endured after the completion of the programmes, which suggests that these strategies initiate lasting changes in the way patients handle their disease.

Pibernik-Okanovic, Prasek et al. (2004) aimed at determining the impact of an empowerment-based psychosocial intervention on the patients' quality of life and glycemic control as compared to patients in standard care. Consecutively recruited Type 2 diabetic patients, scheduled for their regular medical check-ups, were individually acquainted with empowerment-based principles and invited to participate in an empowering psychosocial course.

The response rate was 35% giving a number of 73 patients who were treated in eight separate groups. The treated patients reported their quality of life to be improved after the course in regard to its psychological and social aspects. Their glycemic control also improved and remained so after the 3- and 6-month follow-up periods. Empowerment-based psychosocial intervention in Type 2 diabetic patients was shown to favorably affect their quality of life and to improve their metabolic control, the latter in a modest degree. Better educated patients believing in internal health control and efficacy of diabetes treatment seemed to benefit the most. Further research is needed in order to highlight individual preferences for different educational approaches, as well as the social and cultural factors affecting them (Pibernik-Okanovic et al. 2004).

Patient's knowledge, attitudes, self-care and quality of life are inter-correlated outcomes of diabetes care. Physician knowledge, attitudes about diabetes and its management have also been identified as important factors that influence patient diabetes self-care and the success of the therapeutic regimen on diabetes management outcomes (Corabian et al. 2001). On the other hand, self-care directed toward health protection and health promotion can be defined as the practice of activities initiated or performed by an individual, family, or community to achieve, maintain, or promote maximum health and well-being. Outcomes are associated with patient's characteristics, health status, social support and diabetes education. A study by Corabian and Harstall (2001) indicated that many variables may impact on self-care behaviours with diabetes mellitus and these variables have been grouped into the following four broad categories: (i) Patient characteristics; (ii) Patient social and environmental context; (iii) The disease itself; and, (iv) The patient interaction with diabetes care and with the education provider. Another study showed that empowering patients to effect behavioral change has the potential to change overall health status and to expand resources into other personal and social areas (Corabian & Harstall 2001).

Several studies have shown how diabetes education interventions significantly affected patient outcomes. The Stuifbergen et al. (2000) study examined 786 persons using selected factors influencing health-promoting behaviors or quality of life. Their conclusion was that quality of life is the outcome of a complex interplay involving contextual factors (severity of illness), antecedent variables and health-promoting behaviors. The strength of direct and indirect paths suggests that interventions to enhance social support, decrease barriers, and increase specific self-efficacy for health behaviors would result in improved health-promoting behaviors and quality of life.

The Park and Oh (2005) study, undertaken to identity the effects of a health promotion program for rural elderly on health promotion lifestyle and health status, included 44 elders in the experimental group and 45 elders in the control group. The 16-week health promotion programme was given to the experimental group. The experimental group showed higher scores of a health promotion lifestyle and perceived health status than the control group. In addition, systolic blood pressure, heart rate, body fat and glucose of the experimental group were lower than the control group. However, there were no significant differences in diastolic BP, total cholesterol and right hand grip power between the two groups. This health promotion program for rural elderly can be recommended as an effective nursing intervention in rural communities.

1.4 Summary

Improving diabetic patient knowledge and changing attitudes to self-care can lead to better outcomes for diabetes care. Patients need to be empowered by health care providers in order to successfully comply and adhere to a self-care regimen. Therefore, an education programme is an important intervention method needed to change the patient’s cognitive perception, an essential factor for patient outcomes, in order to boost diabetic patients’ knowledge, adherence to their self-care regimens, glycemic control and quality of life. Other factors, including patient

characteristics, health status, lifestyle, community resources and social support also have an impact on patient self-care and must be taken into account when devising and delivering health care programs. In Taiwan, Aborigines are a special group of people who have a different lifestyle and characteristics to non-Aboriginal people. Therefore, the recognition of these modifying factors is especially important in this study.

1.5 Assumptions of the Study

1. The patient outcomes of diabetes care can be validly measured by the study methods.
2. The patient outcomes of diabetes care can be viewed from a structure-process-outcome perspective.
3. Structure, process, and outcome can be validly and reliably measured by study instruments.
4. The Health Education Model for Taiwanese Aboriginal and non-Aboriginals can be evaluated through patient report and medical record review.

1.6 Summary of this thesis

Following this chapter, a review of the literature provides an overview of (1) The principle of patient education programme design; (2) Patient diabetes education with older people; (3) The theoretical basis of the health promotion model, and (4) The different lifestyles of ethnic groups and how they relate to quality of life outcomes.

In chapter three, the methods used in the study are described. The Pender Health Belief Model was used to guide the development of the intervention and the interpretation of the data. The design, a Randomized Control Trial (RCT), is a follow-up study using a cluster experimental design. The study examined the effect of a health care package on an individual's knowledge, attitudes, self-care behaviours, and blood glucose control after 3 and 6 months.

Chapter four presents the findings from the study; in particular whether a specially designed health care package had a significant effect on patient with Type 2 diabetes mellitus. The quantitative data analysis showed that a health care package had strong associations with well controlled blood glucose levels. According to the data analysis, it concluded that the specially designed health care package decreased the diabetic complications of participants.

The discussion chapter draws together the analysis, discusses the findings from the study, and provides an overview of how the results of this study fit with previous research.

Finally, a number of recommendations are made for further research: (1) Further examination of the relationship between diabetes knowledge, attitudes, self care behaviours, medical record and quality of life is needed. (2) Whether the Patient Education Model could be applied to further study of a health care package and diabetes self care management outcomes should be confirmed with empirical testing. (3) A further study using the Patient Education Model of analysis would provide valuable insight into the understanding of how a patient's characteristic, social support and community resources affect patient's disease perception and patient's disease perception of self care outcomes. (4) In this study, the comparison of the different cultures and lifestyles of Taiwanese Aborigines and non-Aborigines showed that there was no significant difference between the groups with regard to their perceptions about diabetes. Further studies of ethnic differences in diabetes are therefore recommended.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The literature review for this study focuses on (1) The principle of patient education programme design and includes information about learning theory, learning domains, instructional design, assessment, the lesson plan and teaching methods, and adult education principles; (2) Patient education, especially as it relates to older people with Type 2 diabetes; (3) Theory guided interventions which addresses the theoretical basis of the health promotion model and describes the major concepts of the model in deatils; and (4) The different lifestyles of ethnic groups in Taiwan and how they relate to quality of life outcomes.

2.2 The Principle of Patient Education Programme Design

2.2-1 Definition of Learning Theory

PacifiCorp Foundation (2004) define learning as a concerted activity that increases the capacity and willingness of individuals, groups, organizations and communities to acquire and productively apply new knowledge and skills, to grow and mature and to adapt successfully to changes and challenges. They say that learning empowers individuals and organizations to make wise choices, solve problems and break new ground. Further, they claim that it is a sustainable, lifelong, renewable process for people and for the institutions that serve people. Learning includes, but is not limited to, academic studies and occupational training through high school and beyond. It also encompasses the physical, cognitive, emotional and social development of children in the earliest years of their lives (PacifiCorp Foundation 2004).

Previous research has applied learning theory in diabetes education programmes. For example, Miller (1999) used Ausubel's learning theory in a program design and evaluation to assess an educational intervention about the food label designed specifically for women with type 2

diabetes mellitus. The research showed the intervention to be an effective outpatient education program and participant knowledge and perceived confidence in using the food label improved significantly as a result of the intervention. Jenum et al. (2006) applied the social-cognitive learning theory to develop a comprehensive intervention programme to assess the net effects on risk factors for type 2 diabetes and cardiovascular disease. It was used in a community-based, 3-year intervention to increase physical activity in Oslo, Norway, using a baseline investigation of 2,950 30- to 67-year-old participants and a follow-up investigation of 1,776 (67% of those eligible, 56% women, 18% non-Western immigrants) participants. The study showed an increase in physical activity levels, reduced weight gain, and beneficial changes in other risk factors for type 2 diabetes and cardiovascular disease.

2.2-2 Learning domain or Bloom's Taxonomy

Bloom's Taxonomy divides educational objectives into three "domains:" affective, psychomotor, and cognitive. Like other taxonomies, Bloom's is hierarchical; meaning that learning at the higher levels is dependent on having attained prerequisite knowledge and skills at lower levels (Orlich et al. 2004). Bloom identified three domains of educational activities which include cognitive domain, affective domain and psychomotor domain affective is for growth in feelings or emotional areas, while psychomotor is for manual or physical skills. The cognitive domain involves knowledge and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills (Bloom 1956). Affective domain includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes (Krathwohl, et al. 1973). The psychomotor domain includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution (Simpson 1972). Bloom's taxonomy, probably the most widely used educational

theory in use today, is said to be easily understood (Scott 2003). The cognitive domain incorporates knowledge and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. The affective domain includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes. The psychomotor domain includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution (Bloom's Taxonomy 2007).

2.2-3 Instructional Design

Instructional Design is the process of applying instructional strategies that focus on the development of effective student learning. This process can be used for the development of a lesson, an activity, or a course, whether on campus or online. The strategies focus on effective student learning and identifying what the students are expected to learn, guiding in the development of the instructional content, and establishing how the instructor will evaluate the instructional effectiveness (Terra Community College 2005).

According to Gagné et al (1992), the stages of instructional design include the following: 1. Define instructional goals; 2. Conduct an instructional analysis; 3. Identify entry behaviors/learner characteristics; 4. Develop performance objectives. 5. Select an instructional method. 6. Assemble instructional material. 7. Plan and conduct formative evaluation. 8. Plan and conduct summative evaluation.

The office of curriculum development & management (CDM)(2007) explained the importance of distinguishing between instructional goals and instructional objectives. Instructional goals are usually expressed in non-behavioral terms and are generally a more expansive vision than

objectives. Objectives, on the other hand, are expressed in behavioral terms and are usually short-range outcomes. An objective is a description of a desired pattern of behavior for the learner to demonstrate. Despite the different approaches to writing performance objectives, most models include the following three components: (i) Action - Identify the action the learner will be taking when he/she has achieved the objective (e.g., to identify; to measure). (ii) Relevant Conditions - Describe the relevant conditions under which the learner will be acting (e.g., "given the patient's history"; "with the use of the information from the laboratory results"). (iii) Performance Standard - List as many of the actual conditions as possible under which the objective is to be performed (e.g., "must be able to identify at least one possible treatment for the patient's illness by the end of the case study") (www.uab.edu/uasomume/cdm/id.htm)

2.2-4 Assessment of Learning

“Assessment is the process of gathering and discussing information from multiple and diverse sources in order to develop a deep understanding of what students know, understand, and can do with their knowledge as a result of their educational experiences; the process culminates when assessment results are used to improve subsequent learning." (Huba & Freed 2000, p.8). The Qualifications and Curriculum Authority (QCA 2008) identify assessment as an essential part of normal teaching and learning in all subjects. It can take many forms and be used for a range of purposes. To be effective assessment must be ‘fit for purpose’; being clear about what you want the assessment to achieve will determine the nature of the assessment and what the outcome will be. That is, whether the assessment is for use in a classroom situation or for use with patients in an informal teaching situation, the assessment of learning is still essential.

Assessment for learning focuses on the gap between where a learner is in their learning, and where they need to be – the desired goal. This can be achieved through processes such as sharing criteria with learners, effective questioning and feedback (Learning and Teaching Scotland (LTS)

2008). Black and William(cited in LTS 2008) pointed assessment can be defined as all activities undertaken by teachers and/or by their students, which provide information to be used as feedback to modify all teaching and learning activities undertaken (LTS 2008).

Assessment of learning is a powerful way to improve learning and raise standards (QCA 2008). Assessment is ideally integrated into each subject and into every situation in classroom practice which should therefore occur in all forms of education including patient education. QCA (2008) identifies the 10 principles of assessment as: (1) Assessment for learning should be part of effective planning of teaching and learning; (2) Assessment for learning should focus on how students learn;(3) Assessment for learning should be recognised as central to classroom practice; (4) Assessment for learning should be regarded as a key professional skill for teachers; (5) Assessment for learning should be sensitive and constructive because any assessment has an emotional impact; (6) Assessment for learning should take account of the importance of learner motivation; (7) Assessment for learning should promote commitment to learning goals and a shared understanding of the criteria by which they are assessed; (8) Learners should receive constructive guidance about how to improve. Learners need information and guidance in order to plan the next steps in their learning. Teachers should pinpoint the learner's strengths and advise on how to develop them, be clear and constructive about any weaknesses and how they might be addressed and provide opportunities for learners to improve upon their work; (9) Assessment for learning should recognise the full range of achievements of all learners; and (10) Assessment for learning should be used to enhance all learners' opportunities to learn in all areas of educational activity. It should enable all learners to achieve their best and to have their efforts recognised (QCA 2005).

Kwan (2000) explained how student assessment is used to: (1) Differentiate high and low performers, (2) Provide feedback on students’ learning, (3) Help teachers improve their teaching, and/or (4) Decide which students can advance further, and which need to undergo remedial

training or be detained. The same could also be said of patient education where formal assessment allows the educator to detect those who have not acquired the essential information and thus put in place an intervention to address their knowledge deficit.

2.2-5 The Lesson Plan

Lesson planning is a special skill that is learned in much the same way as other skills. It is one thing to surf the Net to retrieve lesson plans from other sites and adapt them to your needs. It is quite another thing to have the skill to develop your own lesson plans (Kizlik 2005). Educators, whether working with students or delivering patient education, need to dvelop the skills required to develop effective learning and teaching strategies, including the development of lesson plans. Riley (2009) points out 10 steps to developing a quality lesson plan: 1. The first thing to consider is what you want to teach and record a time estimate for your lesson plan to help in time budgeting. 2. To make sure your lesson plan will teach exactly what you want it to; you need to develop clear and specific objectives. The objectives should not be activities that will be used in the lesson plan. 3. You need to find out exactly what materials you are going to use later, but they should be shown early in your lesson plan. This way if someone else were going to use your lesson plan, they would know in advance what materials are required. 4. You should write an Anticipatory Set, which would be a way to lead into the lesson plan and develop the students' interest in learning what is about to be taught. 5. Then you should write the step-by-step procedures that will be performed to reach the objectives. 6. After the procedures have been completed, you may want to provide time for independent practice. 7. Just before moving on to the assessment phase you should have some sort of closure for the lesson plan. 8. Now you should write your assessment / evaluation. Many lesson plans don't necessarily need an assessment, but most should have some sort of evaluation of whether or not the objectives were reached. 9. Adaptations should also be made for students with learning disabilities and extensions for others. 10. It is also a good idea to include a "Connections" section, which shows

how the lesson plan could be integrated with other subjects (http://www.lessonplanspage.com/WriteLessonPlan.htm). Kelly (2000) explained that writing lesson plans does not have to be difficult. This is the time that a teacher can show their creativity. Kelly (2000) also suggests how to write lesson plans including: (1) Begin with the end in mind. What do you want the students to learn from this lesson? What standards are you meeting? What does the state or your district require? What age students are you trying to reach? How are you going to assess that learning? Once you've determined this, write a quick description and list out your objectives for the assignment. (2) Create a key vocabulary list that you will add to as you write out your lesson plan procedure. This will help you remember terms that you need to make sure the students understand as they work through the lesson. (3) Create a materials list and add to this as you write your procedure so that you know exactly what you will need including A/V equipment, number of copies, page numbers from books, etc. (4) Determine how you will introduce the lesson. For example, will you use a simple oral explanation for the lesson, an introductory worksheet, or an interactivity of some sort. (5) Decide the method(s) you will use to teach the content of your lesson. For example, does it lend itself to independent reading, lecture, or whole group discussion? Sometimes it is best to use a combination of these methods: beginning with a couple minutes of lecture, followed by a short whole group discussion to ensure that the students understand what you have taught them. (6) Once you have determined how you will teach the content of the lesson, write out supporting information in your notes. (7) Determine how you will have the students practice the skill/information you just taught them.(8) Once you determine how students will practice the skills that you taught them, write out step by step instructions. (9) Create an end of period review. (10) Complete details for any homework or assessments that you will be giving the students. (11) Decide on any accommodations you need to make for your class including accommodations for ESL and special education. (12) Once you have completed your lesson plan, finish out the details including creating the assessments, homework assignments, and any handouts. (13) Finally, make copies and collect materials for

the lesson (http://712educators.about.com/od/lessonplans/ht/lessonplans.htm). According to the above suggestions, diabetes educators can design a lesson plan which should consider the following: the time estimated for the lesson, the specific objectives of the teaching sessions, what materials are required for the teaching sessions, as well as decide on the method(s) which will be used to teach the content of the lesson.

2.2-6 Teaching Methods

Disease prevention through management and education is a cost-effective approach to promoting healthy lifestyles (Yeh et al. 1999; Hu et al. 2001). Numerous diabetes education programs have demonstrated efficacy in improving patient blood glucose control and other factors related to the self-management of diabetes (Galscow et al. 1999; Norris, Engelgau & Narayan 2001). Patient education thus advances self-management of diabetes and has evolved to become a cornerstone of quality oriented diabetes care. To be successful, patient education should be a systemic, patient-centred process aimed at achieving and retaining knowledge and skills necessary to live a satisfactory life. Patients with chronic disease are often adults for whom a specific self-learning, rather than teaching, training approach is required. In particular, specific teaching models are necessary to remind patients of appropriate health behaviours. Life experience, self-direction, and a desire to contribute to one's own wellbeing means that teaching programmes can be less prescriptive and more individually targeted. However, teaching methods and programmes often conflict with patients' needs and learning abilities, which may result in failure to adopt correct and life-long health behaviours. While the current literature identifies the need for individualized and self-directed teaching programmes, there is little information describing objective teaching techniques and learning processes as applied to diabetes (Marina et al. 2004).

The Office of Educational Development (OED)(2004) suggested ten ways to make teaching

effective: (1) Don't make too many assumptions about your audience; in what kind of setting will they receive this information such as large lecture hall or small seminar room or classroom; lighting and sound issues; time of day; take into account the “me, here, now.” ; establish cognitive / behavioral objectives for your audience (2) First day: introduce content; clarify objectives for students; establish tone and expectations. Opening: begin with a provocative question, anecdote, or current event; ask someone in the class to summarize what happened in the last session; use a question box; set up a problem. Closings: plan a rhythm for your class-plan to end with content 5 minutes early, so you can summarize, raise questions, preview the next topic; set aside a time for questions and structure that time; frame or suggest an approach for assigned reading. (3) Preparation: decide what is essential, what is important, and what is helpful; set objectives; plan a lecture to cover less than the entire period; divide the lecture into discrete segments and follow the standard speech structure; lecture from notes or an outline, rather than a complete text. (4) Delivery: be conversational; speak naturally; be yourself; vary your pacing and voice included gauge audience reaction, repeat critical points immediately if you sense the necessity, use your voice to underline and italicize the important points, pause before new points; use gestures to emphasize points; look at the audience; use language to create pictures; observe the techniques of others. (5) Credibility and commitment: think about antecedent image; credibility is enhanced by your own sense of comfort and confidence presenting material or your enthusiasm and interest in teaching or your research and own ideas; commitment is enhanced by relating your own experience, ideas, and feelings or taking the first person approach, not separating yourself from your subject or relating your "passion" for your subject; delivery is tied to both commitment and credibility. (6) Building interaction: learning takes place best in an active, not a passive environment; interaction is a continuous way to determine whether or not your content is understand or share the responsibility of learning more equitably and appropriately; how to build interaction such as have questions prepared-begin with relatively easy, accessible ones or set up hypotheticals, problem-solving exercises,

brainstorming or work to get everyone involved, even in large classes. Ask students to consider issues with the person sitting next to them/jot down ideas, questions, and concerns. Discuss as a larger group. Assign teams to work together on presenting mini-lectures or case studies. Clearly establish expectations about participation. Establish a question box and reward the team and/or individual with the best question of the week or month; Move yourself: Begin class from somewhere besides the front; invite students to consider the issue on board with you, so that you're looking at the board with them. (7) Use the board (slides/overheads) to reinforce your points visually; if you have a great deal of board work, consider having most of it put on the board before class or make a copy of it as a handout; don't talk while you write; limit the amount of material you put on a slide or overhead; have a plan for your board work. (8) Handling questions: explicitly request and encourage questions; be aware of how your behavior and comments can set the tone for questioning; be aware of how your behavior and comments can set the tone for questioning; clarify questions; answer questions as directly as possible; be diplomatic when students raise tangential, overly-complicated questions, or persistently ask questions just to be asking. (9) Getting feedback: get regular feedback; Use eye contact as a tool for continuous feedback; use eye contact as a tool for continuous feedback such as develop your own short questionnaire, hand out 3x5 cards, Be as general or specific as you need to be: "What is going well?" "What is the most important thing you have learned?" discuss the results with your class; borrow students' classnotes from time to time alert them on the first day of class that you'll be doing this and why; arrange to have your lecture videotaped. (10) Test and grades: decide what your goal in testing is; consider the format of questions; consider the format of the exam as a whole; make your grading and testing policies clear on the first day of class (OED 2004). Many of these suggestions will be useful to the diabetes educator who can make use of the relevant suggestions when planning all teaching and learning activities.

Gordon (2003) compared several teaching methods and made the conclusions and recommendations below:

	Lecture	**Seminar**	**PBL group**	**Clinical tutorial**	**One to one clinical attachment**
Efficiency*	High	Medium	Low	Low	Very low
Active learning	Low (usually)	Variable	High	Medium to high	Very high
Mutual feedback	Low	Medium	High	Medium to high	Very high
Modelling behaviour in real life setting	Low	Low	Medium	High	Very high

PBL=problem based learning.

*Based on student numbers. (Gordon 2003, p. 543)

Gordon (2003) also suggested several ways in which teaching can be enhanced such as providing an orientation, agreeing on the ground rules, asking helpful questions, giving the students feedback, and encouraging reflection. The information provided above was incorporated into the teaching and learning plans developed for the study and helped the researcher to develop an effective educational program suited to the needs of the elderly person with diabetes in Taiwan.

2.2-7 Adult Learners

Adult learners are known to have different needs to children and adolescents (Lieb 2008). The field of adult learning was pioneered by Malcom Knowles who identified the following characteristics of adult learners: (1) Adults are autonomous and self-directed. They need to be free to direct themselves. Because of this their teachers must actively involve adult participants in the learning process and thus take on a role of facilitator. Ideally, they should identify

participants' perspectives about what topics to cover and let them work on projects that reflect their particular interests. The teacher should also allow the participants to assume responsibility for presentations and group leadership. The role of the teacher becomes that of a facilitators who, guides participants to their own knowledge rather than supplying them with facts. Finally, they must show participants how the class will help them reach their goals (e.g., via a personal goals sheet). (2) Adults are assumed to have accumulated a foundation of life experiences and knowledge that may include work-related activities, family responsibilities, and previous education. This is valuable information and must be connected to the learning experience. To help achieve this, teachers need to draw out participants' experience and knowledge of relevance to the topic. They must also relate theories and concepts to the participants and recognize the value of experience in learning. (3) Adults are goal-oriented and thus usually know what they want to achieve when they enroll in a course. They, therefore, appreciate an educational program that is organized and has clearly defined elements. Instructors must show participants how this class will help them attain their goals and this should ideally occur early in the process. (4) Adults are relevancy-oriented. In other words, adults must see a reason for learning and for learning to be valued; it must be applicable to their work or other responsibilities. Therefore, instructors must identify objectives for adult participants before the course begins. This means, also, that theories and concepts must be related to a setting familiar to participants. This need can be fulfilled by letting participants choose projects that reflect their own interests. (5) Adults are practical, focusing on the aspects of a lesson most useful to them in their work. They may not therefore be interested in knowledge for its own sake. Instructors must tell participants explicitly how the lesson will be useful to them on the job. (6) As do all learners, adults need to be shown respect. Instructors must acknowledge the wealth of experiences that adult participants bring to the classroom and treat adult learners as equals in experience and knowledge, encouraging them to voice their opinions freely in class (Lieb 2008).

Lieb (2008) explains that another important aspect of adult learning is motivation. At least six factors serve as sources of motivation for adult learning: (1) Social relationships: to make new friends, to meet a need for associations and friendships. (2) External expectations: to comply with instructions from someone else; to fulfill the expectations or recommendations of someone with formal authority. (3) Social welfare: to improve ability to serve mankind, prepare for service to the community, and improve ability to participate in community work. (4) Personal advancement: to achieve higher status in a job, secure professional advancement, and stay abreast of competitors. (5) Escape/Stimulation: to relieve boredom, provide a break in the routine of home or work, and provide a contrast to other exacting details of life.(6) Cognitive interest: to learn for the sake of learning, seek knowledge for its own sake, and to satisfy an inquiring mind. Barriers to learning for adult learners include lack of time, money, confidence, or interest, lack of information about opportunities to learn, scheduling problems, "red tape," and problems with child care and transportation. Lieb (2008) also explains that positive reinforcement by the instructor can enhance learning, as can proper timing of the instruction. Learning results from stimulation of the senses. In some people, one sense is used more than others to learn or recall information. Instructors should present materials that stimulate as many senses as possible in order to increase their chances of teaching success. There are four critical elements of learning that must be addressed to ensure that participants learn. These elements are motivation, reinforcement, retention and transference (Lieb 2008). Lieb (2008) also explained that if the participant does not recognize the need for the information (or has been offended or intimidated), all of the instructor's effort to assist the participant to learn will be in vain. The instructor must establish rapport with participants and prepare them for learning; this provides motivation. Instructors can motivate students via several means such as set a feeling or tone for the lesson, set an appropriate level of concern and set an appropriate level of difficulty. Therefore, when working with adults in a patient education session, the educator must remain aware of the needs of adult learners and

recognize the differences between the learning styles of adult and children. Taking these principles into account will ensure a more effective education session.

2.2-8 Patient Education

Effective patient teaching requires the same analytical and problem-solving skills as other clinical interventions (Habel 2006). The five steps involved in the teaching-learning process are: assessing learning needs and learning readiness; developing learning objectives; planning and implementing patient teaching; evaluating patient learning and documenting patient teaching and learning (Habel 2006).

The purpose of patient education is to influence and change patient's behaviour and produces the changes in knowledge, attitudes, and skills necessary to maintain or improve health (American Academy of family physicians 2000 cited in Rankin et al. 2005). According to Joint Commission on Accreditation of Healthcare Organization(JCAHO) of Goals of Patient Education Standard, patient education should:(1) Promote interactive communication between patients and providers; (2) Improve patient's understanding of their health status, options for treatment, and the anticipated risks and benefits of treatment; (3) Encourage patient participation in decision-making about care; (4) Increase the likelihood that patients will follow their therapeutic plans of care; (5) Maximize patient self-care skills; (6) Increase the patient's ability to cope with his or her health status; (7) Promote health lifestyles; (8) Inform patients about their financial responsibilities for treatment when know (Rankin et al. 2005, p17).

The patient education process, according to Rankin et al. (2005), includes four steps: medical and nursing diagnoses, plan for care, implementation and evaluation. Similarly, according to standards for outcomes measurement of Diabetes Self-management Education (DSME), the following must be taken into account: 1. Behaviour change is the unique outcome measurement for diabetes self-management education; 2. Seven diabetes self-care behaviours include exercise,

eating, medication taking, monitoring of blood glucose, problem solving - especially for blood glucose, reducing risks of diabetes complications, and living with diabetes measures all determine the effectiveness of diabetes self-management education at the individual, participant, and population levels; 3.Diabetes self-care behaviours should be evaluated at the baseline and then at regular intervals after the education programme; 4. The continuum of outcomes, including learning, behavioural, clinical, and health status should be assessed to demonstrate the interrelationship between DSME and behaviour change in the care of individuals with diabetes; 5. Individual patient outcomes are used to guide the intervention and improve care for that patient. Aggregate outcomes are used to guide programmatic services and continuous quality improvement activities for the DSME and the population it serves (Mulcahy 2003, pp.770- 771). Mulcahy (2003) also pointed out that learning outcomes, as one of the goals of diabetes education, is to improve overall health status by empowering the person with diabetes to acquire knowledge, skills, develop confidence and motivation to perform the appropriate self-care behaviours, and develop the problem-solving and coping skills to overcome barriers to self-care behaviours. The clinical outcome is in the overall context of diabetes care - self-care behaviours, along with appropriate therapeutic regiments, that can enhance clinical status, reduce diabetes complications, and improve health status.

The health education provider must know about their clients' health problems and must anticipate the needs patients typically exhibit. To be a capable patient teacher, the health education provider must evaluate their own learning needs; their patient's needs, and find resources to meet them. On the other hand, the health care provider must also understand that cultural factors have a deep effect on patient education. Rather than just assuming that more biomedically 'correct' diabetes knowledge should transfer to better diabetes care, this approach respects the health beliefs of different ethnic and racial groups and incorporates illness explanations of the group (Jack et al. 2008). Outcomes of research that focused on the inclusion

of context and ethnic specific factors demonstrate the efficacy of the inclusion of a culturally appropriate approach to diabetes education. For example, a recent USA study demonstrated significant improvements in dietary and physical activity behaviours in African American and Latino participants in a tailored lifestyle diabetes intervention. Similar results have also been demonstrated with American Indians (Two Feathers et al. 2007). Therefore, patient education for chronic disease, such as diabetes, typically targets lifestyle change, such as dietary habits and daily activities that may be associated with cultural patterns and traditions. Health care providers identify the need to learn about religions and cultures and need to incorporate cultural assessment in the process of patient teaching. It is important to design effective patient teaching interventions and the health care provider needs skills to work with patients from culturally diverse backgrounds by understanding the cultural context of a patient and family, using culturally sensitive strategies to meet joint goals, and integrating appropriate community resources (Garaity 2000 cited in Rankin et al. 2005).

When health education providers assess a patient's background, this means they must address culture-specific demographic factors in accordance to the cultural assessment framework (Huff & Kline, 1999 cited in Rankin et al. 2005). This framework is designed for use in individual patient encounters and health promotion and disease prevention education activities with small groups or in the community. One of five areas is concerned with culture-specific demographic factors. This assessment category evaluates the culture or ethnic group in relation to age, gender, social class or status, education and literacy, language and dialect, religious preferences, occupation and income, patterns of residence, living conditions, and acculturation and assimilation (Rankin et al. 2005, pp. 49-50).

The collaboration of the total health care team is essential to affect positive patient care. The effectiveness of patient education may be enhanced through an interdisciplinary approach whereby a contribution that other health care professionals can make to patient teaching is

acknowledged (Rankin et al. 2005). Research to assess the effectiveness of a perimenopausal health education intervention for mid-life women in northern Taiwan was undertaken by Tsao and Huang (2001). The health education intervention, which had 179 women in the intervention and 174 in the control group, included a health education brochure and one-on-one teaching. The researcher's assessed the educational effectiveness of the intervention by participants' scores on four questionnaires at the beginning of the study and 3 months after initial recruitment. Both groups of women were then compared on changes in their scores on health knowledge, level of perceived uncertainty, health behaviors and perceived perimenopausal disturbances. The findings revealed that the intervention group had significantly reduced scores on perimenopausal disturbances ($p<0.005$) and reported increase practice of healthy behaviors ($p<0.001$) compared to the control group.

A study by Kao and Chang (2002) was designed to compare the effectiveness of patient education with different models over time in patients with hypertension. Subjects, newly diagnosed with hypertension, were selected from a 600-bed teaching hospital in Southern Taipei City and randomly assigned to group or individual groups. The results demonstrated that different education models did improve patients' health knowledge, however, no significant difference was found between the groups. In relation to the changes in blood pressure, both systolic and diastolic blood pressure was significantly lower after the intervention. A significant difference was found in blood pressure readings when assessed before and after the education intervention ($p <0.05$).

The study by Lin (2005) was to investigate the effectiveness of a diabetes shared care model (DSCM). The study aimed to evaluate the effectiveness of the diabetes shared care model (dietary compliance, exercise behavior compliance, clinical indicators) and to examine the factors associated with the hemoglobulin A1c. They analyzed 212 patients who completed the five shared care visits and 739 patients who completed the second follow-up visit. The results of

the study showed that 212 patients who completed the 5 visits had improved compliance with reduced carbohydrate consumption. The analysis of the 739 patients who completed the second follow-up visit found that the compliance of calories and fat consumption was significantly improved.

Patient education with older adults from different cultural groups carries rewards and challenges. The goal of patient education is a holistic process with the goal of changing a patient's behaviour to benefit his or her health status. As research attest to the importance of facilitating lifestyle changes in patients with diabetes, the process of patient education begins at the time of assessment. Following the assessment, of the patient's needs and concerns, the educator and patient collaboratively set goals for desired outcomes. A recent study of facilitating diabetes self-management goal setting in a primary care centre demonstrated that it is possible to train staff to assist patients with realistic goal setting as a means by which to enable successful behavioural change (Christison-Lagay 2007).

Most practitioners involved in patient education recognize the impact of the family on patient's behaviour. A close, supportive family may facilitate the integration of new health behaviours; a family that is in conflict or that lacks understanding often poses barriers to behavioural change. Strong religious, ethnic, or cultural beliefs may also influence or prevent desired change (Rankin et al. 2005, p.73). Social support has been found to have an impact on healthy lifestyles and health outcomes. The support derives from social networks, social relationships and social linkages, all from which the person derives significant support (Berkman 1995; Kaplan & Hartwell 1987; O'Reilly & Thomas 1989; Seeman 1996). This is evident also in people with diabetes where social support has been found to play a pivotal role in diabetes prevention and glycemic control. Recent research has shown that social support improves a patient's knowledge, understanding and awareness of diabetes, and it also improves patient compliance to dietary plans, self-care management, and emotional adjustment (Jennings, Morgan & Barnett 1987;

Maxwell, Hunt & Bush 1992; Toljamo & Hentinen 2001; Zrebiec & Jacobson 2001) whereas lack of social support has been linked to mortality in other illnesses, especially myocardial infarction in elderly persons (Orth-Gomer 1988). A recent study examined the relationship between social support and mortality for older patients with diabetes. The researchers found, after controlling for age, health status, physical function and other potential confounders, that social support still played a significant role in mortality (Zhang et al. 2007). “Social support influences the living environment from which patients receive information, help, care, and services and in which they perceive intimacy, attachment, belonging, encouragement, reassurance of worth, a sense of reliable alliance, and a feeling of being loved “(Zhang et al. 2007, p. 279). Thus social support is an extremely important resource to persons with diabetes.

Health education is therefore an important aspect of health promotion. It is a helping process using learning theories and teaching techniques that promote the client’s knowledge, attitudes, and skills to voluntarily connect in a wellness lifestyle. Planning interventions involves making decisions about patient education setting, content, resources, and instructors. Teaching programmes also assist in the measurement of the effectiveness of patient education. Through outcome measurement, planning teaching programmes must be continually evaluated to declare effectiveness. Teaching tools, such as handouts, videos, and models, are helpful reinforces of teaching. The right educational materials are correct, age-specific, easily accessible, and appropriate to learner needs (Rankin et al. 2005).

When participants learn from one another and teach one another through their own experiences, group learning takes advantage of adult learning principles. Group learning helps learners feel less alone, and fosters positive attitude development. Because the most effective adult education involves active involvement, and group classes allow participants to share knowledge and experiences with one another, group teaching is better used to help learners process and integrate information with behaviours, rather than to cover a great deal of data in a short amount

of time. Group classes also take preparation time that makes them cost-effective only when the same programme can be offered repeatedly. In addition, although group members have slightly different learning goals, they may share a few worldwide concerns and questions. Group teaching includes three styles: small groups (2 to 5 learners); medium-sized groups (6 to 30 learners), and large groups (30 or more learners) (Rankin et al., 2005, pp225-226). Large groups are appropriate for community education of health promotion or illness prevention. Large group sessions are most effective when brief lectures and videos are interspersed with small group experiences or discussion, to enable active involvement (Cantillon 2003, cited in Rankin et al. 2005).

Group teaching is appropriate in settings where there are enough patients with the same cognitive or affective learning needs. An important consideration in offering group classes includes whether transportation and time are convenient, and whether patients and their families can attend. Group teaching also helps families gain added support from health professionals and other patients and their families. Group teaching can be used to influence patients to perform their health behavoiur. On the other hand, teachers need a strong understanding of the health problem being addressed in the patient education session (Rankin et al. 2005, p.253).

Rankin et al. (2005) suggested several ways to help the patient and family take active roles in learning, and enjoy patient education: match learning activities with learning objectives; keep the patient and the family involved through discussion, role-play, games, and media; incorporate a variety of methods to teach skills and the patient's attitude, never use lectures alone; build success and reinforcement into the teaching process, test the patient's new abilities to help him or her feel a sense of accomplishment; make learning fun; provide enough time to practice skills (p.254). In addition, most elderly Taiwanese patients have a low literacy level. Rankin et al. also suggested in the guidelines for teaching patients with low literacy skill: focus information on the core of knowledge and skills patients need to endure and handle problems; teach the smallest

amount possible; make points vivid. Put important information either first or last. Sequence information logically, for example, step-by step (1, 2, 3, chronological - a time line), or topical (using 3 or 4 main topics); Have the patient restate and demonstrate; or review (Rankin et al. 2005, p. 251).

Finally, evaluation of diabetes education programmes occurs at different points of the teaching and learning process and must use different methods to gather the types of information needed. Evaluation measures the degree to which patient learning goals have been met and uses findings to improve or forward patient care. Certification of patient education focuses on patient outcomes: knowledge, skill, and health behaviours (Rankin et al. 2005, p. 310). Thus the evaluation of a programme must be planned appropriately and addressed accordingly along the way.

2.3 Patient Diabetes Education with Older People

It is evident that diabetes education is therefore an accepted and integral part of the management of diabetes. The overall goal of diabetes education is to assist the patient to accept and integrate the diabetes management tasks successfully into their lifestyle and self-concept, in order to achieve and maintain optimum diabetic control (Dunning 2003).

As outlined in earlier sections of the thesis, good glycemic control depends on the coordination of diet, exercise, and medication (Huang, Wu, Jeng, & Lin 2004). Diabetic education focuses on teaching patients about a balanced diet, the need for daily medication, exercise, and blood or urine monitoring for glucose level. Therefore, successful control of diabetes is dependent upon extensive patient self-care skills. In Taiwan, however, there is no data available about how successful current diabetic education programs are in encouraging patients to engage in self-care. However, in general it is evident that lower activity levels and poorer health functional status is

evident in elderly groups when compared to younger age groups in their community (Sinclair, Conroy & Bayer 2008). Therefore, the present study seeks to investigate some effects of different educational programs in regards to diabetes care on glycemic control in the elderly in areas of Taiwan. How well patients engage in self-care skills is affected by knowledge of diabetic self-care including meal planning, insulin injection, exercise, and the self-monitoring of blood glucose. Self-monitoring of blood glucose can provide feedback to change patients' behaviour and improve compliance (Huang et al. 2004). Gilden et al. (1990, cited in Huang et al. 2004) studied elderly diabetics, between 60 and 79 years. The results showed that subjects who self-monitored blood glucose were more likely to adhere to medication orders; they also found that this method was easier to fit into the subjects' personal schedules, easier to record, less embarrassing, and entailed no interference in their quality of life.

Corabian and Harstall (2001) suggested that patient's characteristics and the amount of stress and style of stress management are predictive of self-management behaviors and influence the success of the regimen on diabetes control. They identify eight factors that influence success. (1) Patient's profile is an important factor in diabetes self-management behavior resulting in a broad spectrum of attitudes and health behaviors depending on variables such as age, gender, health status (disease severity, co-morbidities, and complications), ethnicity, culture, socio-economic status, marital status and education. (2) Limited knowledge about diabetes and its complications and diabetes self-management skills can interfere with implementation of effective diabetes management regimen. However, knowledge is a necessary but insufficient condition for the behavioral change needed to ensure improved diabetes outcomes in the long-term. (3) The learning abilities and literacy level of each individual have been identified as important factors that influence diabetes self-management. (4) Personality features such as extreme personality styles, low self-esteem, external locus of control, or poor ego development have been associated with poor compliance and adherence to diabetes self-management.

Hardiness or a personal resistance to stress and self-efficacy have been correlated positively with compliance and adherence to self-management practices and may have a positive impact on diabetes management. (5) Patients with diabetes may be more prone to eating disorders or depressive and anxiety disorders including blood and needle phobias, which may interfere with diabetes self-management practices. Other psychiatric disorders such as substance abuse and personality disorders may also be barriers to behavioral change. (6) Health beliefs (including thoughts about health and illness, perception of health in the presence of illness, understanding of susceptibility to illness and perceived efficacy of therapies) and ethnic understanding and conceptualization of diabetes may have a strong impact on adherence to diabetes self-management behaviors. Perceptions of health and well being appear to be important in coping with the stresses of disease but not necessarily with metabolic control. Patients may be more attentive to and concerned about controlling symptoms and maintaining a sense of well being than maintaining metabolic control. (7) Strategies for coping with specific problems or stress may affect the patient's ability to self-manage diabetes. (8) Effects of trauma such as psychological distress, psychiatric disorders and certain coping styles may be direct barriers to behavioral change (Corabian et al. 2001, pp. 22-23). The study also pointed out that barriers to behavioral change may come from the disease itself and/or as a result of the diagnosis, the regimen and/or the complications, irritability and depression which can be induced metabolically as a result of fluctuations in glucose levels (Corabian et al. 2001). Many people with Type 2 diabetes do not engage in all prescribed diabetes self-management behaviors or do so incorrectly. Certain aspects of the therapeutic regimen, such as dietary restrictions, meal schedules, and others (which involve unpleasant and socially unacceptable behaviors) often separate patients from the routines of their lives. Patients find it particularly difficult to deal with changes in diet. For many people, food represents a connection to emotional and social needs. Other people may encounter barriers to a diabetes regimen because of their

socio-economic context and/or lack of knowledge about what foods to buy for their dietary regimen.

Exercise has also been identified as a difficult aspect of the diabetes regimen for patients to manage. The anticipation or onset of diabetes-related complications may also represent barriers to diabetes self-management. Fear of complications may prevent acceptance and problem solving. The time lapse between the diagnosis of diabetes and the onset of complications may make it difficult for patients to link present care with future consequences. Thus the delivering of education programmes designed to bring about behavioural changes is challenging. The progressive nature of the disease, compounded by the clinically manifested complications, may add further psychological stress. Also, some particular complications (deficit of vision, cardiovascular functioning, dexterity and ambulation) can make it difficult to exercise, test blood glucose levels accurately or administer medication (particularly insulin) appropriately (Corabian et al. 2001, pp. 24- 25).

Patient Diabetes Education (PDE) suggests either individual or group sessions as effective ways of delivering education. Basically, however, the decision is determined by what the educator considers to be the most appropriate for the particular cohort. The sessions should provide information mainly in relation to diabetes and self-management skills, with occasional attention paid to psychosocial concerns and behavioral change. During the last decade, the PDE approach and delivery have changed. Many changes have occurred as a result of recent technological advances in the management and care of diabetes. New knowledge about the importance of metabolic control, discovery of newer and better therapies, and improvements in the technology for monitoring and measuring glucose levels have raised hope that patients can attain greater levels of independence and self-management. It has been suggested that the ability and readiness of patients to learn is dependent on their needs and personal beliefs that educational messages are

meaningful only when the person who hears them is ready and willing to learn. Various theories of learning and behaviour including strategies to increase compliance and adherence have been tested and reported in the literature (Lo 1999; McGhan 2005). For example, Lo (1999) assessed factors which correlate with the expected success of health regimen adherence in 146 insulin-dependent diabetes mellitus (IDDM) subjects. The results indicate that success in complying with a health regimen is associated with good family support and rapport with health professionals. Health professionals have a role in engendering optimism, in maintaining enthusiasm, and facilitating and encouraging maintenance in health behaviours. McGhan (2005) commented how many studies show a refreshing focus on how to teach and have made substantial contributions to testing educational theories and making meaningful improvements to those with chronic medical conditions. Their successful education programs include behavior change strategies, shared care practices and communication skills, plus the importance of a clear educational process tailored to client needs and influencing factors, with multiple teaching formats along a continuum of care.

PDE is about patient empowerment and the purpose is to provide a combination of diabetes knowledge and self-management skills, and heightened self-awareness regarding values, beliefs, needs, and goals so that patients can use this power to make informed decisions about their behaviours and act in the best interests of their own self-care. The more traditional definition views PDE as a process designed to influence the knowledge, attitudes and behaviour of patients to enhance compliance with treatment recommendations in order to improve their diabetes control (Corabian et al. 2001).

The PDE programme's main goal is to promote self-management that in turn may lead to long-term diabetes control to reduce associated morbidity and mortality, increase patients' quality of life (QOL), and reduce costs. Its success should be measured in terms of both

long-term and short-term outcomes. The program produces short-term outcomes, which act as the stepping-stones to the desired long-term outcomes. The short-term outcomes should include improved glucose control, and reduction of the presence of cardio-vascular risk factors (such as obesity, hypertension, smoking and high blood lipid levels). Participants attending a PDE program in all probability change through improvement in an underlying process or mediating variables such as knowledge, attitudes, self-efficacy or sense of control, health beliefs, health locus of control, personal models, problem solving, coping skills, intentions, motivations, and social support. These changes are then translated into improvements in one or more areas of diabetes self-management behavior including changes in lifestyle and medical self-care and monitoring and/or in one or more areas of diabetes management (associated with the patient-provider interaction) (Corabian et al. 2001).

It has been recommended that greater attention be focused on assessing the organizational practices of the location in which PDE takes place, specific patients' characteristics, quality of life, short-term and long-term outcomes (such as diabetes complications and mortality rate)(Corabian et al. 2001). In addition, researchers designing an intervention programme have been advised to consider racial disparities. Hargraves and Hadley (2003) examined to what degree health insurance coverage and available safety net resources reduced racial and ethnic disparities in access to care. The result showed that for most of the measures, lack of health insurance was the single most important factor while income differences were generally the second most important factor. Researchers also consider that different age groups of elders might have different perceptions and different health-promoting lifestyles (Dunning 2005). Categorizing elderly into different groups could help community nurses to design specific and effective health-promotion interventions.

According to Dunning (2005), some older people with diabetes are unable to perform some self-care tasks and require assistance. These older people need accepted diabetes education frameworks to improve their diabetes management tasks into their lifestyle to maintain a balanced lifestyle and optimum metabolic control. However, few older people in Taiwan have had access to a quality education. Although standardized diabetes education guidelines exist, most are not developed for older people. In addition, each person should be assessed and a teaching plan developed to ensure individual learning needs are addressed. On the other hand, health education providers designing a diabetes education guideline for older people should consider their psychological and intellectual changes. These changes include: decline in short-term memory; small decline in both simple and complex motor performance; reduction in reaction time by approximately 20% such as when complex decisions are required, the stimulus to action is weak or not relevant to the individual, and the motor sequence needed to complete the task is complex; reduced ability to understand concepts; increased cautiousness and unwillingness to change or take risk; low self-image and self-efficacy, which may inhibit the person from participating in a group programme; and sensory loss (Dunning 2005, p.190).

Dunning (2005) also suggested that health educators providing diabetes education to older people should follow these principles: (1) Have established beliefs, attitudes, problem-solving and decision-making process, behaviour and habits; (2) Have a great deal of life experience. Older people learn best when the information is relevant to their everyday lives and they can put new information into the context of what they already know; (3) Present them with an overview of what the education session will involve. In addition, the education is more likely to be effective if the person: believes they need information about diabetes, believes their life will be affected if they do not know about diabetes and how to manage it, has confidence in their ability to manage, and expects and actually receives positive benefits from the education; (4) Learn by sharing their experiences with other people and bring a variety of experiences and knowledge to

any learning encounter, and they respond to an interactive teaching style. In addition, Dunning (2005) recommended that educators assess older people's feelings and beliefs, psychosocial situation, education level, copy style, learning style, goals, ability to perform self-care behaviours and educators should know how to encourage older people to identify and express what they wish to know about diabetes management (pp.190-191).

On the other hand, it is important, though useful, to teach specific strategies for educating older people such as ways of proceeding from the simplest information to more complex concepts/tasks; break each topic into smaller chunks and use illustrations and practical examples to explain the information; use a variety of teaching methods to cater for individual learning styles; seek feedback, ask questions and involve people in the teaching encounter; allow time, but do not have sessions that are too long because it is difficult for older people to concentrate for long periods and sitting may become uncomfortable; and use clear concise handouts to complement and reinforce the information provided (Dunning 2005, p.194). It is also important to take factors such as health literacy into account. Health literacy is the degree to which individuals have the capacity to obtain, process, and understand basic health information. Inadequate health literacy is known to be related to poor disease-related knowledge and self-management strategies (Baker 1999; Williams, Baker, Parker & Nurss 1998).

2.4 Theory Guided Interventions

Table 2: Characteristics and outcomes of educational interventions included in the review from 1998 to 2008

Study	*Focus of paper, participants*	*Intervention*	*Outcomes*	*Conclusion*
Gaede et al. Danmark (2001)	To assess the effect of intensified education, on diet, exercise, and smoking (I: 80, C: 80)	All patients in both groups informed of basic diabetes guidelines, I: individual diet interventions and patients set their own goals. Group intervention regarding diet, exercise and smoking, C: nr (I I: more, D I: more, F: more)	Metabolic control + I, metabolic control − C, dietary behaviour+, weight reduction −I and C, no difference between groups in time used to exercise	Dietary behavior analyzed other self-care skills not measured. High resources and only modest changes in behavior
Swinburn et al. (2001)	To determine whether reducing dietary fat would reduce body weight and improve longterm glycemia in people with IGT.	I: 1 year structured education program, with monthly small group education sessions focused on reducing fat content, goal setting, and self-monitoring using food	Body weight +I No differences were found at 5 year follow-up.	The natural history for people at high risk of developing Type 2 diabetes is weight gain and deterioration in glucose tolerance. This process may be ameliorated through adherence to a reduced fat intake.

Table 2 (continued): Characteristics and outcomes of educational interventions included in the review from 1998 to 2008

Study	*Focus of paper, participants*	*Intervention*	*Outcomes*	*Conclusion*
Miller et al.USA (2002)	To evaluate nutrition intervention on intervention on blood glucose and lipoprotein levels (I: 47, C: 45)	I: 10-w sessions in healthy eating. Each session lasted 90 min. Theory of Meaningful learning and Social Cognitive Theory, C: usual care (I I: more, D I: less, F: less)	Metabolic control + I, metabolic control, nc C, treatment goals for total cholesterol+	Nutrition education improves metabolic control among older adults
Schwedes et al. Germany and Australia (2002)	To investigate the effect of meal-related SMBG on glycemic control and well-being in non-insulin treated people (I: 113, C: 110)	I: instruction in use of SMBG device and measure BG six times daily, before and 1 h after main meal and record the values in a diary for BG and well-being. Seen by a nurse every 4 w, six times and asked to reflect on self-regulation and life with diabetes, C: counseling on diet and lifestyle (I I: more, D I: less, F: less)	Metabolic control + I, metabolic control + C, weight reduction + I, weight reduction + C, satisfaction with treatment I + and C, well-being + I	Keeping a diary and recording eating habits and SMBG enabled more autonomous self-care

Table 2 (continued): Characteristics and outcomes of educational interventions included in the review from 1998 to 2008

Study	*Focus of paper, participants*	*Intervention*	*Outcomes*	*Conclusion*
Brown et al. USA (2002)	To compare 2 interventions designed for Mexican Americans (I: 126, C: 114)	I: 2-h weekly sessions for 3-m, diet, exercising, SMBG. 6-m of 2-h biweekly and 3-m of monthly 2-h sessions to promote behavior change. 52-h contact. Family member brought to the program., C: usual care, 1-y waiting list (I I: more, D I: more, F: more)	Metabolic control + I, metabolic control − C, BMI + I, BMI − C, knowledge + I and C	Culturally specific education for Mexican Americans is beneficial. High resources and only modest changes in behavior
Sone et al. Japan (2002)	To asses if long term life-style intervention can improve glycemic control and prevent complications (I: 1105, C: 1100)	I: dietary habits, physical activities and adherence to treatment. 15 min telephone counseling sessions at least once every two weeks, C: usual care (I I: more, D I: nr, F: more)	Metabolic control + I and C, BMI + I, BMI nc C	No instruments used to measure QoL, well-being or self-care skills
Rickheim et al. USA (2002)	To compare effectiveness of delivering diabetes education in either a group or individual setting using consistent evidence-based curriculum. (I: 87 (group education) C: 83 (individual education)	Both groups received the same education, diet, SMBG, physical activity, foot care, problem solving emphasizing to empower and meeting the needs of an adult learner, 5–7 h of education over 6-m (I I: less, D I: less, F: less)	Metabolic control + I and C, BMI + I and C, knowledge + I and C, attitude + I and C, QoL + I and C	Group education is as effective as individual education. The optimal group size is not known

Table 2 (continued): Characteristics and outcomes of educational interventions included in the review from 1998 to 2008

Study	*Focus of paper, participants*	*Intervention*	*Outcomes*	*Conclusion*
Diabetes Prevention Program Research Group (2002)	To evaluate whether a lifestyle intervention (diet and physical activity) or the administration of the drug, Met form in, would prevent or delay the development of diabetes.	I: health care settings and involved education, advice and behaviour modification skills for 150 mins/week. 16 lesson curriculum taught on a one-to-one basis during the first 6 months. Participants attended regular 3-monthly individual and group behaviour modification and support sessions.	Risk reduction : + I,	Lifestyle interventions are more effective than drugs in the prevention of Type 2 diabetes in high risk groups. The results emphasise the importance of lifestyle interventions in the prevention of Type 2 diabetes.
Cooper et al. UK (2003)	To find if intervention impacting upon illness beliefs and leading to changes in self-care behaviors affects blood glucose control (I: 53, C: 36)	8 weekly group sessions, 2-h each, diabetes nurses, experiential learning, diet, exercise, emotions, SMBG goals, behavior change, C: nr (I I: more, D I: less, F: more)	Metabolic control − I, metabolic control + C, attitude + I, self-care + I and C	Reflection was useful to clarify and interpret complexities of self-care. Supportive environment was helpful and patients valued collaborative learning

Table 2 (continued): Characteristics and outcomes of educational interventions included in the review from 1998 to 2008

Study	*Focus of paper, participants*	*Intervention*	*Outcomes*	*Conclusion*
Huang et al. (2003)	The aim of this study is to verify whether life style intervention can facilitate control of glucose, cholesterol and triglyceride levels, which are the major risk factors of arteriosclerosis and complication.	I: 1. asking patients to take diets followed recommendation of the dietitian; 2. asking patients to exercise with mild to moderate activity, 40-60minutes a day, at least 4 days in a week. Thereafter, all patients were interviewed at least every other month as well as to measure patient's glucose, cholesterol, triglyceride, BUN, and creatinine.	Metabolic control + I Physiological indicators +I , reduced systolic blood pressure +I,	The results support that life style change under the CPDPC education project can effectively facilitate DM control and hence reduce the risk factors of DM complications.
Acik et al. Turkey (2004)	To analyze effects of patient education, diet and regular exercise on blood glucose control (I: 33, C: 33)	I: diet counseling C: usual care (I I: less, D I: less, F: less)	Metabolic control + I, metabolic control − C, BMI + I, BMI − C	No instruments used to measure QoL, well-being or self-care skills
Pibernik-Okanovic et al. Croatia (2004)	To determine the feasibility of empowerment educational program on patients' quality of life and HbA1c level (I: 73, C: 35)	I: 6 w group sessions, goal setting, problem solving, coping with diabetes, seeking social support, and staying motivated. Discussion and practical exercises, C: Usual care (I I: less, D I: less, F: less)	Metabolic control + I, metabolic control, nr C, self-care behaviors + I, quality of life + I	Patients perceived benefits from the program, support from professionals, not being criticized and stimulated for self-care

Table 2 (continued): Characteristics and outcomes of educational interventions included in the review from 1998 to 2008

Study	*Focus of paper, participants*	*Intervention*	*Outcomes*	*Conclusion*
Anderson-Lofti et al. USA (2005)	To test culturally appropriate dietary self-management intervention in African–Americans (I: 49, C. 48)	I: four weekly classes on diet, included in social events. Four monthly 1-h peer-professionals discussion groups, learning about diabetes. Weekly follow-up calls by nurses, C: diabetes classes for 8-h (I I: more, D I: less, F: less)	Metabolic control + I, metabolic control + C, BMI + I, BMI − C, dietary behavior + I	Culture is an important part of life and affects dietary chooses. Self-care skills or emotional aspects not measured
Deakin et al. (2005)	To assess the effects of group-based, patients-centred training on clinical, lifestyle and sychosocial outcomes in people with Type 2 diabetes.	Studies were obtained from computerised searches of multiple electronic bibliographic databases. Randomised controlled and controlled clinical trials which evaluated group-based education programmes for adults with Type 2 diabetes compared with routine treatment, waiting list control or no intervention.	Metabolic control + I, knowledge + I, reduced systolic blood pressure +I, reduced need for diabetes medication+ I	Group-based training for self-management strategies in people with Type 2 diabetes is effective by improving fasting blood glucose levels, glycated haemoglobin and diabetes knowledge and reducing systolic blood pressure levels, body weight and the requirement for diabetes medication.

Table 2 (continued): Characteristics and outcomes of educational interventions included in the review from 1998 to 2008

Study	*Focus of paper, participants*	*Intervention*	*Outcomes*	*Conclusion*
Balamurugan et al. (2006)	To discuss the barriers faced during the implementation of Diabetes self-management education (DSME) programs in medically underserved rural areas of Arkansas.	10 to 13 hours of education to each program participant. Baseline, 6-month, and year-end data were collected on preventive care practices, such as daily blood glucose monitoring, foot examination, systolic and diastolic blood pressure, and glycosylated hemoglobin level	Metabolic control + I	Preventive care practices improved: daily blood glucose monitoring, daily foot ,HbA1C, However, many anticipated and a few unanticipated barriers during the implementation of the program could not be overcome because of the lack of an evaluation plan.

I, intervention; C, control; h; hour; y, year; w, week; m, month; +, positive change; −, negative change; nc, no change; nr, not reported; BG, blood glucose; SMBG, self-monitoring blood glucose; I I, intensity of intervention; D I, duration of intervention; F, follow-up assessment.

These articles reviewed confirm the usefulness of diabetes education to encourage people to change their lifestyle and to improve control blood glucose. From the articles reviewed, the most important indicators were as follows: lifestyle interventions are more effective or adjunctive than drugs in the prevention of Type 2 diabetes in high risk groups; it also provides understanding into culture as an important part of life and how it affects dietary choices. In order to control diabetes, it is important to focus on an effective educational intervention.

2.5 The theoretical basis for the health promotion model

Several models are used in patient education. One of them is the Health Promotion Model. The current Health Promotion Model (HPM) makes an exclusive contribution to patient education through its focus on the commitment to a plan of action and immediate competing demands and preferences. Evaluating the patient's commitment to a plan of action is pivotal to planning an educational intervention (Rankin et al. 2005). The HPM proposed a framework for integrating nursing and behavioural science perspectives on factors influencing health behaviours. The initial HPM stimulated a number of studies to describe the potential of seven cognitive-perceptual factors and modifying factors to explain and predict health behaviours (Pender 2006, pp.47- 48).

The revised HPM first appeared in the third edition of Health Promotion in Nursing Practice (Pender 1996). Three new variables appear in the revised model: activity-related affect, commitment to a plan of action, and immediate competing demands and preferences (Pender 2006, p.51). The Pender Revised Health-Promotion Model (RHPM) provides a theoretic frame of factors influencing health-promotion behaviours and integrates nursing and behavioural science perspectives, mainly the Expectancy-Value Theory and Social Cognitive Theory. According to Pender, 3 major groups of factors influence health-promoting behaviours: individual characteristics and experiences; behaviour-specific cognitions (which include

interpersonal influences from family, peers, providers, and situations) and affect; and immediate behavioural contingencies. Health-promoting behaviour is the desired behavioural outcome (Wu & Pender 2005).

According to Pender's HPM, demographic characteristics are considered as modifying factors that may influence individuals' health promotion learning (HPL). These demographic factors include age, education, social status, marital status, living arrangements, and chronic health problems, and were assumed as predictors for this study. These factors were selected because they demonstrated significance in influencing either the health promotion or disease prevention behaviors of women and the elderly in Taiwan (Ke 1994; Wang et al. 1992; Wang & Hsu 1997). Among cognitive-perceptual factors of the HPM, perceived health status (PHS), perceived benefits of health promotion lifestyle (PBeHPL), and perceived barriers to health promotion lifestyle (PBaHPL) were selected as predictor variables of HPL. According to Pender (1987), cognitive-perceptual factors were identified as the "primary motivational mechanisms for acquisition and maintenance of health promotion behavior" (p. 60).

Further, in Pender’s Health Promotion Model (1987), determinants of a health-promoting lifestyle are categorized into cognitive-perceptual factors, modifying factors, and variables affecting the likelihood of action. Cognitive-perceptual factors are identified as "the primary motivational mechanisms for acquisition and maintenance of health-promoting behaviors" (Pender 1987, p.60). These factors include importance of health, perceived control of health, perceived self-efficacy, and definition of health, perceived health status, and perceived benefits and barriers to health-promoting behavior. Modifying factors include demographic, biological, interpersonal, situational, and behavioral factors. According to Pender, "health promotion focuses on movement toward a positively valence state of enhanced health and well-being" (1987, p.57).

The Health Promotion Model (HPM) seeks to explain individual characteristics and experiences, as well as how behavior-specific cognition and affect influence these behavioral outcomes (Pender et al. 2002). According to Pender et al. (2002), there are two types of individual characteristics and experiences that affect behavioral outcomes. The first is prior related behaviors that an individual possesses. The second is personal characteristics such as biological, psychological, and socio-cultural experiences. These individual characteristics and experiences interact with the interpersonal and situational influences to shape the behavioral outcomes. In addition, there are four behaviour-specific variables with equally important influence upon behavioural outcomes.

These four variables are the perceived benefits to action, perceived barriers to action, perceived self-efficacy, and activity-related affect. The variables, in combination with interpersonal and situational influences are the ingredients for an individual's commitment to a plan of action. Hopefully, an individual's commitment to the plan of action will result in a health promoting behavior. Unfortunately, the resulting health promoting behavior is dependent upon immediate competing demands over which an individual has low control and preferences over which an individual has a higher level of control. The factors that influence health behaviors are multidimensional. All factors are interrelated and therefore produce results that exert both direct and indirect influences on health promoting behaviors. These factors cooperatively support the processes that influence individuals to make decisions and participate in health promoting behaviors.

Identification of the interrelationships and an understanding of the dynamics that facilitate health specific behaviors provide insight to both health compromising and health enhancing behaviors, and is what makes the model useful to researchers. Social support is viewed as an interpersonal influence, a cognition focused on the behaviors, beliefs, or attitudes of other individuals. Social support is defined as a "network of interpersonal relations that provide companionship,

assistance, and emotional nourishment" (Pender et al. 2002, p.239). Individuals assess socially supportive resources and then accept or reject them based on perceived societal norms and individual needs. Involvement or participation in socially supportive groups is a likely resource of social support for many individuals.

Often, social support groups serve to assist with personal strengths of members and help in the accomplishment of long-term goals (Pender et al. 2002). Social support groups are considered a protective mechanism of health promoting and health maintenance behaviors. Conceptually, social groups can create growth promoting environments, decrease stressful life events, provide feedback or confirmation of actions, and buffer the negative effects of stressful life events. When individuals perceive adequate group support, the resulting goals of health promotion, health maintenance, and disease prevention are more likely to be achieved.

According to Pender et al. (2002), the Health Promotion Model is based on the following assumptions, which reflect both nursing and behavioral science perspectives:

1. Persons seek to create conditions of living through which they can express their unique human health potential.
2. Persons have the capacity for reflective self-awareness, including assessment of their own competencies.
3. Person's value growth in directions viewed as positive and attempts to achieve a personally acceptable balance between change and stability.
4. Individuals seek to actively regulate their own behavior.
5. Individuals in all their bio psychosocial complexity interact with the environment, progressively transforming the environment and being transformed over time.
6. Health professionals constitute a part of the interpersonal environment, which exerts influence on persons throughout their lifespan.

7. Self-initiated reconfiguration of person-environment interactive patterns is essential to change (Pender et al. 2002, p.63).

The HPM is based on the following theoretical propositions:

1. Prior behavior and inherited and acquired characteristics influence beliefs, effect, and enactment of health-promoting behaviour.
2. Persons commit to engaging in behaviors from which they anticipate deriving personally valued benefits.
3. Perceived barriers can constrain commitment to action, a mediator of behavior as well as actual behavior.
4. Perceived competence or self-efficacy to execute a given behaviour increases the likelihood of commitment to action and actual performance of the behaviour.
5. Greater perceived self-efficacy results in fewer perceived barriers to a specific health behaviour.
6. Positive affect toward a behaviour results in greater perceived self-efficacy, which can in turn result in increased positive affect.
7. When positive emotions or affect are associated with a behavior, the probability of commitment and action is increased.
8. Persons are more likely to commit to and engage in health-promoting behaviours when significant others model the behaviour, expect the behavior to occur, and provide assistance and support to enable the behaviour.
9. Families, peers, and health care providers are important sources of interpersonal influence that can increase or decrease commitment to and engagement in health-promoting behaviour.
10. Situational influences in the external environment can increase or decrease commitment to or participation in health-promoting behaviour.

11. The greater the commitment to a specific plan of action, the more likely health-promoting behaviors is to be maintained over time.
12. Commitment to a plan of action is less likely to result in the desired behavior when competing demands over which persons have little control require immediate attention.
13. Commitment to a plan of action is less likely to result in the desired behaviour when other actions are more attractive and thus preferred over the target behavior.
14. Persons can modify cognitions, affect, and the interpersonal and physical environment to create incentives for health actions (Pender et al. 2002, pp.63-64).

Therefore, through modification of personal understanding, attitudes and behaviours a patient's health maybe promoted. Based on the proposition of the Health Promotion Model, health consequences are associated with perceived importance of glycemic control, understanding of what Type 2 diabetes mellitus is, perceived diabetes status, perceived self-efficacy with diabetes, perceived benefits of glycemic control and perceived barriers to glycemic control. It is hypothesized that modifying factors of patient characteristics and community resources and social support will affect cognitive factors. The aim of this intervention in group health education is to alter cognitive-perceptual factors of the patient, based on knowledge, and attitudes, while the capacity for self care by patients with diabetes mellitus could cause a change toward self-care prevention by influencing the perception of diabetes mellitus can result in the patient changing self-care practices.

2.5-1 Description of the major concepts in the Health Education Model

In this section the component of the major concepts in the Health Education Model will be described. Firstly, the modifying factors including patient characteristics, community resources and social support will be outlined. Secondly, the cognitive-perceptual factors including a patient's personal interpretation of the importance of diabetic caution, followed by the definition

of Type 2 diabetes mellitus, a patient's perceived diabetes status, their perceived self-efficacy with diabetes, perceived benefits of diabetes control and their perceived barriers to diabetes control will be discussed. Finally, the necessity to apply intervention and measure patient outcomes, including diabetic knowledge, attitudes, and capacity, self-care behaviours, and quality of life will be identified. In this theoretical model, modifying factors, cognitive-perceptual factors and intervention method are independent variables; and patient outcomes are dependent variables.

(1) Modifying factors

Modifying factors include: characteristics of the patient, community resources and social support.

Patient characteristics

This section discusses how a patients' character affects their perception of diabetes mellitus knowledge, attitudes and behaviours towards diabetes. This section includes: 1. Demographic variables: gender, age, education, ethnicity, and occupation, etc.; 2. Health status: length of time since diagnosis, co-morbidities, and type of treatment. Patient demographics and bio-physical characteristics are known to affect diabetes management and influence quality of life. Physical and psychological health outcomes are proven when chronic illness is successfully self-managed.

Community resources and social support

This section discusses how patients obtained and used community resources and social support to affect their perception of diabetes mellitus knowledge, attitudes and behaviours. This section includes: 1. Interpersonal influences (family, peers, providers); norms, support, model. 2. Situational factors: media resources, geographic isolation, communication transport, health services, financial support, religion and educational services

(2) Cognitive-perceptual factors

This section discusses how people learn, and use Type 2 diabetes mellitus knowledge. It includes: patient's perception of the importance of controlling diabetes; diabetes status; self-efficacy with diabetes; benefits of control diabetes; perceived barriers to control glycemia.

(3) Intervention method: a health care package of Type 2 diabetes mellitus

This section discusses a health care package of Type 2 diabetes mellitus. The education programme includes three topics: 1. What is diabetes: introduction to diabetes, signs and symptoms, treatments, hyperglycemia and hypoglycemia, and complications; 2. Diabetes and meal planning: a healthy diet, six food groups, how much is a serving of starch , what are healthy ways to eat starches, how much should you eat each day and how to control your body weight; 3. Home care of diabetes: exercise plan, medicine management, self-monitoring of blood glucose, foot and wound care, preparing to travel with diabetes and introduction to support systems in Taiwan. In this educational intervention programme, teaching provider used several teaching ways including lecture, role play, practice and experience sharing to enhance learning ability of older people.

(4) Outcomes for the patients

In this section, the conceptualization of diabetes knowledge, attitudes, capacity for self-care behaviours and quality of life associated with this study is discussed and followed with a review of literature on the subjective meaning of the quality of life.

Conceptualization of Knowledge, Attitudes with Diabetes Mellitus

The primary purpose of diabetes education is to offer knowledge and skill training, help individuals identify barriers, and facilitate problem-solving and coping skills to achieve effective self-care behaviour (Mulcahy et al. 2003). Therefore, this study considered the

importance of perceived benefits and perceived barriers to action, perceived self-efficacy, and activity-related affects for participants to design education programmes, and then success in changing their lifestyle to enhance their quality of life.

Diet, exercise, and medication

Good blood glucose control depends on the triple coordination effect of diet, exercise, and medication. Common medical nutritional strategies for the management of Type 2 diabetes include reducing caloric intake, decreasing total fat consumption (approximately 30% of total caloric intake) and saturated fat intake (less than 7% of total calories), minimizing intake of trans fats, and encouraging a dietary fibre intake of 14 g/1,000 kcal (American Diabetes Association 2007). The distribution range of protein intake in individuals with diabetes is similar to that for the general population (10–35% of energy intake; average of approximately 10% of calories), usually not exceeding 20% of energy intake. The recommended range of carbohydrate intake is 45–65% of total calories (minimum 130 g/day)(Sheard 2004). Garg, Bonanome, Grundy, Zhang and Unger's (1988) research demonstrated the effect of exercise on blood glucose control. The program recommended walking, jogging, cycling, and treadmill cycling. The exercise regimen is 20-60 min per session for programmes ranging from one week to two weeks in length. The frequency of exercise is typically between three to five times per week for longer programmes, with the one week intensive course having daily sessions. To preserve central nervous system function, blood glucose levels are remarkably well maintained during physical activity. In patients with Type 2 diabetes, it is believed that physical activity may improve insulin sensitivity and assist in diminishing elevated blood glucose levels into the normal range (American Diabetes Association 2004). The Asian-Pacific guidelines recommend that patients with Type 2 diabetes accumulate at least 150 minutes of walking per week (Asian-Pacific Type 2 Diabetes Policy Group 2005).

Further, research has shown that exercise can assist in attaining blood glucose control through improved glucose tolerance and insulin sensitivity, the lessening of body weight, substandard blood glucose and hemoglobin A1c (HbA1c), and improving metabolism (Hornsby et al. 1990; Barbard, Jung & Inkeles 1994). Studies have also pointed to a combined therapy of diet and exercise being better than either one on its own.

Exercise and diet are thus the cornerstones of management of non-insulin-dependent diabetes mellitus (NIDDM). Many older people however have difficulty in exercising, missing benefits associated with glycemic control, weight, cardiac disease and mood. According to Samaras et al. (1997), the outcomes of a 6 month structured exercise and support programme based on a health promotion model, on physical activity, glycemic control and parameters of cardiovascular risk in non-exercisers, compared with standard outpatient clinic education, showed that exercise can benefit older people. However, studies pointing to poor patient observance to recommendation appear with disappointing regularity. The reason for non-compliance and complex and poorly understood information include lack of self motivation and self esteem, inability to utilize resources, physical barriers and socioeconomic restrictions. These real and perceived barriers to exercise are not addressed in traditional diabetes education (Samaras et al.1997).

Pender (1987) defines health-promoting behaviours as those that become an integral part of an individual's lifestyle, such as physical exercise and nutritional eating practices. Exercise reportedly has strong psychological, social, and physiological benefits for both young and older individuals. Nutrition and diet, balanced with exercise, also have been found to have a direct, positive, cumulative effect on general health and well-being of adults. Pender (1987) suggested that when a researcher is structuring appropriate health promotion programmes, age and gender must be considered, as well as exercise, nutrition and diet. (Volden et al. 1990)

Self-monitoring of blood glucose can change patients' behavior and improve compliance (Funnell & Merritt 1993 ; Gilden, Casia, Hendryx, & Singh 1990 cited in Brown et al. 2002). In addition, the Brown et al.(2002) study found that intervention involved 3 months of weekly instructional sessions on nutrition, self-monitoring of blood glucose, exercise, and other self-care topics and 6 months of bi-weekly support group sessions to promote behavior change. The results show that experimental groups showed significantly lower levels of HbA1C and fasting blood glucose at 6 and 12 months and higher diabetes knowledge scores.

Conceptualization of Self-Care Behaviour with Diabetes Mellitus

The Seven diabetes self-care behaviours were identified as key behaviours to diabetes self-management: (1) Physical activity (exercise) (2) Diet (3) Medication taking (4) Monitoring of blood glucose (5) Problem solving especially for blood glucose: high and low levels and sick days (6) Reducing the risks of diabetes complications (7) Living with diabetes: psychosocial adaptation (Mulcahy et al. 2003).

Physical Activity (Exercise)

Navuluri (2001) states that physical activity or exercise is a cornerstone in the management of diabetes, a stressful chronic disease. Exercise conveys many benefits such as lowering blood glucose levels, decreasing obesity, increasing insulin sensitivity, reducing macro-vascular and micro-vascular complications, reducing hypertension, reducing lipid levels, therefore eventually leading to reduced morbidity and mortality due to diabetes. Physical activity is a self-care behavior meaning that it is initiated by individuals own feelings towards well-being. Adherence to exercise, which refers to the extent to which a person's behavior coincides with medical or health advice, requires challenging lifestyle changes for even the most disciplined individuals.

The American Diabetes Association technical reviews on exercise in patients with diabetes have summarized the value of exercise in the diabetes management plan. Regular exercise has been shown to improve blood glucose control, reduce cardiovascular risk factors, contribute to weight loss, and improve well-being. Furthermore, regular exercise may prevent Type 2 diabetes in high-risk individuals. All levels of physical activity, including leisure activities, recreational sports, and competitive professional performance, can be performed by people with diabetes who do not have complications and have good glycemic control. The ability to adjust the therapeutic regimen in insulin therapy and medical nutrition therapy (MNT) is an integral component of diabetes management and of diabetes self-management education. The assessment of the nutrition status of a patient, followed by nutrition therapy, is an important management strategy (ADA 2002).

Physical activity (exercise) is the act of expending energy and it consists of 2 types of exercise: aerobic activity such as walking or running and anaerobic activity such as weight lifting. Physical activity improves blood glucose control, reduces stress, improves the body mass index, enhances weight loss and helps control lipids and blood pressure. The risk of developing Type 2 diabetes mellitus is reduced through lifestyle intervention consisting of moderate physical activity and modest weight loss (ADA 2002). A primary goal of DSME is to increase the physical activity of an individual with diabetes. The optimum goal is to engage in moderate aerobic activity for 20 to 30 minutes, 3 to 5 times per week (Chin, Cook, Jin et al. 2001).

Diet

Regulation of blood glucose to achieve near normal levels is a primary goal in the management of diabetes, and thus, dietary techniques that limit hyperglycemia following a meal are important in limiting the complications of diabetes. Both the amount (grams) of carbohydrate as well as the type of carbohydrate in a food influences blood glucose level. The total amount of

carbohydrate consumed is a strong predictor of glycemic response, and thus, monitoring total grams of carbohydrate, whether by use of exchanges or carbohydrate counting, remains a key strategy in achieving glycemic control. Low carbohydrate diets are not recommended in the management of diabetes. Although dietary carbohydrate is the major contributor to postprandial glucose concentration, it is an important source of energy, water soluble vitamins and minerals, and fiber. Thus, in agreement with the National Academy of Sciences-Food and Nutrition Board (cited in Institute of Medicine of the National Academies 2002), the recommended range of carbohydrate intake is 45–65% of total calories. In addition, because the brain and central nervous system have an absolute requirement for glucose as an energy source, restricting total carbohydrate to <130 g/day is not recommended (American Diabetes Association 2005 check ref)(Institute of Medicine of the National Academies 2002).

The eating behaviours associated with diabetes include carbohydrate and fat gram counting, label reading, and measuring foods for portion allotment. Following diabetic meal plans can decrease A1C by 1% to 2%, LDL cholesterol can decline 15 to 25 mg, a decreasing blood pressure, and weight loss of 1 to 2 pounds per week. Every meal plan is specially designed for diabetic patients and therefore based on individual eating models, educational and behavioural goals must consider barriers or facilitators of environmental triggers, cultural, financial and emotional concerns (Mulcahy et al. 2003).

Standard assessment questions, such as 24-hour recall and frequency of food intake allows for the evaluation of eating behaviours. Educators check patient's baseline blood glucose and food records (using labels, restaurant menus, food models, etc). In addition, they must consider the amount of food eaten, the timing of meals, and the effect of food on blood glucose. These assessments need to take place every 2 to 4 weeks, and then every 3 to 6 months. It is also an

essential factor in assessing the patient's knowledge of preventive behavior (Mulcahy et al. 2003).

Monitoring of Blood Glucose

Monitoring of the blood glucose can lead to a decline in the acute complications of diabetes, such as diabetic ketoacidosis and severe hypoglycemia. A study suggests that proper glycemic control could improve diabetic patients in cognitive function, quality of life, and well-being. It could lessen psychological problems, reduce medical complications and medical costs (Mellitus, Jeng, Huang, Wu & Lin 2004). Short-term complications such as hyperosmolar hyperglycemic non-ketotic syndrome (HHNK), infection, and hypoglycemia could place the patient's survival at risk. Long-term complications consisting of macro vascular complication (coronary artery disease, claudication and stroke) and micro vascular complications (retinopathy, neuropathy, and nephropathy) are the major causes of death in the older population. In addition, the ADA's suggest that self-monitoring of blood glucose (SMBG) is a component of effective therapy. SMBG allows patients to evaluate their individual response to therapy and assess whether glycemic targets are being achieved. Results of SMBG can be useful in preventing hypoglycemia and adjusting medications, medical nutrition therapy (MNT), and physical activity. Self-management of diet, exercise and medications is the essential factor to control glycemia. Daily SMBG is especially important for patients treated with insulin to monitor for and prevent asymptomatic hypoglycemia and hyperglycemia. Patients with Type 2 diabetes on insulin typically need to perform SMBG more frequently than those not using insulin.

Problem Solving Especially for Glycemic Control

More recent treatment of Type 2 diabetes mellitus includes lifestyle changes such as diet control and exercise; medications such as oral hypoglycemic agents and/or insulin; and promotion of self care abilities such as foot care and blood glucose. Treatment consequence results in glycemic

control, which is indicated by the level of blood glucose. In clinics, the level of blood glucose is measured in terms of one or more of the following: fasting blood glucose, two-hour postprandial blood glucose, and glycosylated hemoglobin. The short-term state of blood glucose is measured by fasting blood glucose and postprandial blood glucose (standard times are 7 am, 11 am, 4pm and 9pm)(Dunning 2003, p37). A person with Type 2 diabetes should have a visit with a diabetes care provider every three months. A thorough three-month evaluation includes: (1) Glycosylated hemoglobin (HbA1c) is a weighted three-month average of what your blood glucose has been. This test measures how much glucose has been sticking to the red blood cells. It also indicates how much glucose has been sticking to other cells. A high HbA1c is an indicator of risk for long-term complications. Currently, the ADA recommends an HbA1c of less than 7% to protect oneself from complications. This test should be done every three months. (2) Blood pressure check. (3) Foot and skin examination. (4) Ophthalmoscopy examination. (5) Neurological examination. (6) The following evaluations should be done at least annually: (a) Random microalbumin (urine test for protein). (b) BUN and serum creatinine. (c) Serum cholesterol, HDL, and triglycerides. (d) ECG. (e) Dilated retinal examination (Los Angel Chinese Center 2008).

According to Wang et al. (1998), the research results indicated: the mean value for HbA1C was 7.12%; and 63.1% of the patients belonged to the moderated to well controlled group, male patient's HbA1C value was significantly lower than female patient's. In addition, patients with no religious belief also had a lower HbA1C value than patients with a religious background, there were strong negative correlations between self-care behaviors, social support, and self-efficacy and HbA1C. In addition, the Brown et al.(2002) study found that the effectiveness of culturally competent diabetes self-management education improved health outcomes of Mexican Americans, particularly for those individuals with HbA1C levels greater than 10%.

Reducing Risks of Diabetes Complications: Weight Management

Being overweight and obese is strongly linked to the development of Type 2 diabetes and can complicate its management. Obesity is also an independent risk factor for hypertension and dyslipidemia as well as coronary vascular diseases (CVD), which is the major cause of death in those with diabetes. Moderate weight loss improves glycemic control, reduces CVD risk, and can prevent the development of Type 2 diabetes in those with pre-diabetes. Therefore, weight loss is an important therapeutic strategy in all overweight or obese individuals who have Type 2 diabetes or are at risk for developing Type 2 diabetes. The primary approach for achieving weight loss, in the vast majority of cases, is therapeutic lifestyle change, which includes a reduction in energy intake and an increase in physical activity. A moderate decrease in caloric balance (500–1,000 kcal/day) will result in a slow but progressive weight loss (1–2 lb/week). For most patients, weight loss diets should supply at least 1,000–1,200 kcal/day for women and 1,200–1,600 kcal/day for men.

Physical activity is an important component of a comprehensive weight management program. Regular, moderate intensity, physical activity enhances long-term weight maintenance. Regular activity also improves insulin sensitivity, glycemic control, and selected risk factors for CVD (i.e., hypertension and dyslipidemia), and increased aerobic fitness decreases the risk of coronary heart disease (CHD). Initial physical activity recommendations should be modest, based on the patient's willingness and ability, gradually increasing the duration and frequency to 30–45 min of moderate aerobic activity 3–5 days per week, when possible. Greater activity levels of at least 1 h/day of moderate (walking) or 30 min/day of vigorous (jogging) activity may be needed to achieve successful long-term weight loss (American Diabetes Association 2005).

Reducing Risks for Diabetes Complications, amputation and foot ulceration are the most common consequences of diabetic neuropathy and major causes of morbidity and disability in

people with diabetes. People with neuropathy or evidence of increased plantar pressure may be adequately managed with well-fitted walking shoes or athletic shoes. Patients should be educated on the implications of sensory loss and the ways to substitute other sensory modalities (hand palpation, visual inspection) for surveillance of early problems. People with evidence of increased plantar pressure (e.g., erythema, warmth, callus, or measured pressure) should use footwear that cushions and redistributes the pressure. Health professionals with experience and training in foot care. People with bony deformities (e.g., hammertoes, prominent metatarsal heads, and bunions) may need extra-wide shoes or depth shoes. People with extreme bony deformities (e.g., Charcot foot) that cannot be accommodated with commercial therapeutic footwear, may need custom-molded shoes (American Diabetes Association 2005).

Conceptualization of Compliance and Adherence to Regimens: living with diabetes-psychosocial adaptation

Major requirements in diabetes management are patient compliance with the regimen and adherence to self-management behaviors. Diabetes is a chronic illness that requires significant behaviour change through adherence to maintain a complex health care programme. Adherence is a factor influenced by social support (Trief, Ploutz-Snyder, Britton & Weinstock 2004). Lack of adherence to diabetic self-management treatments is connected to a high risk of diabetes complications (Ciechanowski, Katon, Russo & Walker 2001). Balkrishnan et al .(2003) found strong associations between decreased anti-diabetic medication adherence and increased health care service utilization in older adults with Type 2 diabetes mellitus in a managed care setting (Balkrishnan et al. 2003). Garay-Sevilla and Nava (1995) used a cross-section study to examine factors related to adherence to diet and medication in non-insulin-dependent diabetes mellitus (NIDDM) patients. They found that (1) adherence to treatment in NIDDM patients is connected with social support; (2) some aspects linked to the family, such as the age of the spouse and the

control of behaviour, were also associated with compliance to treatment; and (3) it is significant for practicing physicians, and for institutional programs, to consider factors connected with adherence to treatment.

In addition, depression has been linked to poorer diet and medication regimen adherence, functional impairment, and higher health care costs in primary care diabetic patients (Ciechanowski, Katon & Russo 2000). This is a significant issue when the care of the elderly with Type 2 diabetes is considered and should be taken into account by clinicians and educators working with elderly patients.

A study by Corabian and Harstall (2001b) suggested that patients may improve and maintain compliance and adherence to diabetes self-management if they are enabled to play more informed and active roles and have control over their own care. Patients' knowledge about their disease, their ability to monitor it, and their motivation to self-management behaviors are also influencing factors. Many physiological, psychosocial and environmental factors may influence and determine the extent to which patients are able and willing to contribute to their own self-care. Findings from the qualitative research reviewed suggested that poor adherence and compliance may be rooted in the complexity of what has to be learned, managed and integrated with the patient's personal identity and current lifestyle.

Decisions related to diabetes management and self-care must be congruent with patients' views of themselves within the context of their lives. The routine but complex decision-making process was grounded in faith, trust, support, values and beliefs. Family and personal events, personal views of themselves, health beliefs, attitudes toward diabetes, current health status, relationships with significant other/family members/friends, attitudes of and relationships with diabetes care and education providers, and anticipation of the future may all be incorporated in the decision making process. Patients wanted to maintain their previous lifestyle and considered

the impact of the therapeutic regimen on their lives. To modify behaviors, they needed to perceive advantages of the changes as greater than the perceived disadvantages. The decision to assume control of diabetes management was perceived as a positive turning point in the patient's life, giving the individual a sense of well- being (Pender et al.2006)

Conceptualization of Quality of life

Quality of life is an important health outcome in its own right, representing the ultimate goal of all health interventions. Quality of life is measured as physical and social functioning, and perceived physical and mental well-being. People with diabetes have a worse quality of life than people with no chronic illness, but a better quality of life than people with most other serious chronic diseases (Silverstein et al. 1997). The duration and type of diabetes are not consistently associated with quality of life. Intensive treatment does not impair the quality of life, and having better glycemic control is associated with a better quality of life and complications of diabetes are the most important disease-specific determinant. Numerous demographic and psychosocial factors influence quality of life and should be controlled when comparing subgroups. Studies of clinical and educational interventions suggest that improving patient health status and perceived ability to control their disease, results in improved quality of life. Methodologically, it is important to use multidimensional assessments of quality of life, and to include both generic and disease-specific measures (Rubin & Peyrot 1999). A model of quality of life is planned that associates objective and subjective indicators. It is investigated from five dimensions: physical wellbeing, material wellbeing, social wellbeing, emotional wellbeing, and development and activity (Felce & Perry 1995). At the second-class status, the goal of supportive care is accomplishing optimal functioning and well-being. The best measured method is from the patient's perspective. The usual concern for symptom control, familiar to the palliative-care physician, can conceptually be expanded into a consideration of costs and benefits of various

treatment options relative to their subjective perception of personal function and well-belling (Cella 1994).

Hiltunen et al. (1996) found that diabetes and impaired glucose tolerance were linked to impaired functional ability in the elderly and cardio- cerebrovascular disease were predictors of this impairment. Where diabetic complications and symptoms have affected older adults, the quality of life was found to be poorer among diabetic patients, and compared with the same age of other people, diabetic subjects more often had symptoms of ischemic heart disease (Hiltunen, Keinanen-Kiukaanniemi, Laara & Kivela 1996).

Quality of life is an important topic in diabetic patients and is linked to demographic, medical-history, and self-management. Factors connected to lower quality of life included: less education, lower income, older age, being female, type of health insurance, number of diabetes complications, number of co - morbid illness, and lower levels of physical activity (Glasgow, Ruggiero, Eakin, Dryfoos & Chobanian 1997).

Boye et al. (2007) assessed the health-related quality of life (HRQoL) of patients with Type 2 diabetes mellitus in Spain using the EQ-5D, to describe factors associated with patients' HRQoL and to evaluate the agreement between patients' and physicians' HRQoL assessments. A total of 294 patients were consecutively enrolled at primary care centres. Patients completed the EQ-5D and physicians the EQ-5D proxy version. Results from the study showed, HRQoL scores were significantly lower in patients with higher body mass index, with diabetes complications, with >15 years of diabetes, and in patients taking insulin plus oral treatment ($p<0.05$). Most EQ-5D dimensions showed good agreement between patients' and physicians' assessments. In patient and physician multivariate models, significant predictors of lower HRQoL included older age, lower education, current insulin use and diabetes complications ($p<0.05$).

Based on the Health Promotion Model, Blacconiere and Oleckno (1999) health-promoting lifestyles of employees working in local public health departments (n = 602) in order to test two research hypotheses. The study found public health professionals tended to report more favorable health-promoting behaviours than departmental support staff, and that occupational discipline was a significant predictor of a particular health-promoting lifestyle. Their finding pointed towards a health-promoting lifestyle that encompasses far more than preventing disease and is characterised by behaviours that lead to optimal well-being, self-actualisation, and personal fulfillment. Johnson et al. (1993) undertook a study using Pender's (1987) Health Promotion Model to evaluate Pender's hypothesis that demographic and biological characteristics affect health-promoting behaviors indirectly through three mediating cognitive-perceptual variables. A sample of 3,025 noninstitutionalized adults completed a telephone survey from which indicators of the conceptual variables were selected. Initial tests of the causal model using the LISREL 7 program indicated that the basic model did not fit the data. Therefore, the model was modified so that the exogenous variables-sex, age, income, marital status, education, and body mass index-had direct effects on select health-promoting behaviors. Further, the variables of self-actualization and interpersonal support were required to share common indicators as were health responsibility and interpersonal support. Though the modified model fit the data, little of the variance in health-promoting behaviors was explained, since all significant effects were weak (Johnson et al. 1993).

Individual Chacteristics and Experiences

According to Pender (2006), each person has unique personal characteristics and experiences that affect subsequent actions. The importance of their effect depends on the target behaviour considered (p.51). Individual characteristics and experiences includes prior related behaviour and personal factors; biological, psychological and sociocultural.

Prior Related Behaviour

Pender (2006) identified that about 75% of studies supported prior related behaviour as being important in determining subsequent behaviour. Prior behaviour is proposed as having both direct and indirect effects on the likelihood of engaging in health-promotion behaviour. The direct effect of past behaviour on current health-promotion behaviour may be due to habit formation, predisposing one to engage in the behaviour automatically, with little attention to the specific details of its execution. Habit strength accrues each time the behaviour occurs and is particularly augmented by concentrated, repetitive practice of the behaviour. An indirect influence on health-promotion behaviour is through perceptions of self-efficacy, benefits, barriers, and the activity-related affect (p52).

Personal Factors

In the revised HPM, personal factors are categorized as biologic, psychological, and sociocultural. Biologic factors include age, body mass index, pubertal status, menopausal status, aerobic capacity, strength, agility, or balance. Psychological factors include self-esteem, self-motivation, and perceived health status. Sociocultural factors include race, ethnicity, acculturation, education, and socioeconomic status (Pender 2006, p.52).

There are several studies that have explored individual characteristics and experiences affecting health promotion behaviours. Davis et al. (2001) assessed the relationship between self-reported ethnicity, metabolic control, and blood pressure during treatment of Type 2 diabetes. They studied 2,999 newly diagnosed Type 2 diabetic patients recruited to the U.K. This study showed important ethnic differences in body weight, lipid profiles, and blood pressure, but not glycemic control, during the 9 years after diagnosis of Type 2 diabetes. AC patients maintained the most favorable lipid profiles, but hypertension developed in more AC patients than WC or IA patients.

Ethnicity-specific glycemic control of Type 2 diabetes seems unnecessary, but other risk factors need to be addressed independently.

Chen et al. (2007) compared 265 Taiwanese and 285 American adolescents using a cross-sectional questionnaire survey for health-promoting behavior. Their research found that public health professionals need to be cautious in regard to cultural differences. They also suggested health promotion programs should focus on factors for which there may be significant local ethnic differences. Quandt et al. (2005) analyzed data from a cross-sectional survey of 693 randomly selected older adults with Type 2 diabetes in rural North Carolina. Participants were derived from Native American, African American and 'White'groups. Capillary blood samples were collected for HbA1C analysis. These data indicated that older ethnic minorities in rural communities are at increased risk for diabetes complications and need diabetes management strategies to improve glycemic control.

Based on Pender's Health Promotion Model, Lucas et al. (2000) investigated cognitive-perceptual factors and modifying factors in understanding the participation of community-living older adult women in health-promoting behaviors of health responsibility, physical activity, nutrition, spiritual growth, interpersonal relations, and stress management. The results indicated that age, marital status, race, education, and self-esteem and the two health-related factors of perceived health and health self-determinism made statistically significant contributions to the health-promoting behaviors of physical activity, nutrition, spiritual growth, and interpersonal relations. Identified benefits included better psychological well-being, coping with the general issues of aging, social interaction, improved function, and management of existing health problems. Internal barriers focused on perceived physical difficulties with all types of health-promoting behaviors.

The Cooper-Patrick et al. (1999) research used a telephone survey of 1816 adults who had

recently attended 1 of 32 primary care practices associated with a large mixed-model managed care organization in an urban setting. They suggested that improving cross-cultural communication between primary care physicians and patients and providing patients with access to a diverse group of physicians may lead to more patient involvement in care, higher levels of patient satisfaction, and better health outcomes.

Behaviour-Specific Cognitions and Affect

In the revised HPM, behaviour-specific cognitions and affect includes: (1) Cognitive-Perceptual Factors: perceived benefits of action, perceived barriers of action, perceived self-efficacy, activity-related affect; (2) Interpersonal influences factors (family, peers, providers): norms, social support, modeling and situational influences factors: options, demand characteristics aesthetics.

Cognitive-Perceptual Factors

According to Pender et al. (2006, pp.52-54) of the studies that tested the Health Promotion Model, 61% reported empirical support for the importance of perceived benefits in influencing health. In the HPM, perceived benefits are proposed as directly motivating behaviour whereby, patients actively engage in self-management of their diabetes. The HPM also indirectly motivates behaviour by creating a commitment to a plan of action from which anticipated benefits will result. Anticipated benefits arise as a result of the positive consequences of behaviour. The motivational importance of anticipated benefits results from prior personal experience of the behaviour through observational learning from others engaged in the behaviour. If individuals have a positive experience, they will tend to invest more time and resources into related activities.

Perceived barriers are important determinants of health-promoting behaviour. Barriers consist of perceptions concerning the unavailability, inconvenience, expense, difficulty, or time-consuming nature of a particular action. They often provoke reasons to avoid certain behaviours and these barriers to action directly affect behaviour as well as indirectly affecting motivation or commandment to a plan of action.

Self-efficacy, according to Bandura (1997, cited in Pender et al. 2002) is defined as "the judgment of personal capability to organize and execute a particular course of action" (p.70). In the HPM studies reviewed, self-efficacy was seen as a major determinant of health-promoting behaviour. Personal knowledge about one's self-efficacy is based on four types of information: (1) Self-performance evaluation based on some self-standard or external feedback given by others, (2) Vicarious experiences of observing the performance of others and their related self-evaluation and feedback, (3) Verbal acknowledgement by others that reinforces one's own belief in self (4) According to Pender's theory, ongoing subjective states affect how patients respond to behavioural events. These subjective responses may be mild, moderate, or strong and are cognitively labeled, stored in memory, and associated with subsequent thoughts of the behaviour. Another study supports this theory. The Hays and Clark (1999) study demonstrated the benefits of regular physical activity for the prevention and management of Type 2 diabetes. They demonstrated that physical activity improves glycemic control through increased insulin sensitivity and glucose tolerance.

Several researchers have shown cognitive-perceptual factors as important in relation to patient's health promotion behaviours. Wu and Pender (2005) used 2-wave panel data to test the health promotion model. The aim of the study was to establish how individual characteristics, cognitions, and interpersonal influences predicted the physical activity of Taiwanese adolescents. The findings suggest that gender, social support, modeling, self-efficacy, and

perceived benefits and barriers to performing physical activity, directly and indirectly influence the behaviour of physical activity in Taiwanese adolescents. Shin et al. (2005) also found strong relationships between self-efficacy and health behaviour change and maintenance among patients with chronic diseases.

Callaghan (2006) identified the influences of selected basic conditioning factors on the practice of healthy behaviors, self-efficacy beliefs, and ability for self-care in 256 adolescents. The results showed those significant relationships between the following basic conditioning factors and adolescents' practice of healthy behaviors, self-efficacy of those behaviors, and self-care abilities: support system, adequate income, adequate living conditions, gender, routine practice of religion, and reported medical problems/disabilities.

Interpersonal Influences

According to the HPM, interpersonal influences are cognitions concerning the behaviour, beliefs, or attitudes of others. Primary sources of interpersonal influences on health-promoting behaviours are family, peers and health care providers. Interpersonal influences include norms, social support and modeling (vicarious learning through observing others engaged in a particular behaviour). These three interpersonal processes affect an individual's predisposition to engage in health-promotion behaviours. In the HPM, interpersonal interaction influences health-promotion behaviours directly as well as indirectly through social pressures or encouragement to commit to a plan of action (Pender 2006, p. 55).

Yeh and Liu (2003) pointed towards social support as being important in the daily activities of the elderly. Their study used a cross-sectional stratified random sample of 4,993 elderly city residents in Taiwan utilising a face-to-face interview. Their result showed that cognitive function was positively correlated with functional status in ways consistent with available

knowledge. The results of the study confirm the findings of two earlier studies that found a positive association between social support and cognitive function. In their study, marriage and perceived positive support from friends were significantly and positively associated with cognitive function. Loneliness and living alone were not significantly associated with cognitive function.

Zimmer et al. (2005) found that an older adult's educational level is strongly associated with mortality. While the educational providers supporting education should consider where families are highly integrated, the education of family members may be linked to survival. Such may be the case in settings where there are large gaps in levels of education across generations and high levels of resource transfers between family members. Research that employed 14 years of longitudinal data from Taiwan to examine the combined effects of education of older adults and their adult children on mortality outcomes of older adults. Results indicate that educational levels of both parent and child are associated with older adult mortality, but the child's education is more important when controlling for the health of the older adult. Further, when examining only those older adults who already report a serious chronic condition, they suggested different roles for education in onset versus progression of a health disorder that may lead to death (Zimmer et al. 2005). In addition, low socio-economic status is increasingly being identified as a risk marker for chronic diseases (Cackett et al. 2008). The Cackett et al. (2008) study aimed to assess the association between socio-economic status and the prevalence of age-related macular degeneration (AMD). The study conclusions showed low educational level to be associated with a higher prevalence of early AMD signs in the Asian population, independent of age, cardiovascular risk factors and cigarette smoking.

Toljamo and Hentinen (2001) suggest that poor metabolic control, low control of smoking and living alone predicted neglect of self-care, but if patients had support from family and friends,

living alone was not an adverse condition to self-care. If peer support does not encourage diabetes self-care, then patients are moved to have poor metabolism control. A similar study by Wen, Shepherd et al. (2004) showed that family members' support (more than just a spouse or significant other) was associated with higher levels of diet and exercise self-care of older adults. They also suggested that diabetes educators and healthcare providers should think about involving the family members to support self-care management for older adults with Type 2 diabetes mellitus. Improved diabetes management can be addressed through enhancing family support specific to diabetes, self-efficacy, and barriers to self-care. Psychological, and environmental barriers challenge self-management of diabetes mellitus especially by older adults (Anderson & Halter 1989, cited in Wen et al. 2004). Physical challenges, such as vision and hearing impairment, cognitive impairment and, depression may also affect older adults with diabetes in terms of sufficient economic resources, transportation limitations and social isolation, and may also affect ability to adhere to self-management practices. Therefore, the amount of family support an older patient receives is likely to enhance self-management.

Some studies have shown that strong family and social support appear to have a positive impact on glycemic control and/or self-management behaviours (Fisher et al. 2000; Albright et al. 2001; Boehm et al, 1997, cited in Wen et al. 2004). In addition, the Anderson and Svardsudd (1995), and La Greca et al. (1995) studies, found that families provided more support than friends for insulin injections, blood glucose monitoring, and meals. In contrast, friends provided more emotional support for people who had diabetes than families. Friends however also play important roles in diabetic patients managing their illness.

The Social Cognitive Theory (SCT)(Pender et al. 2002, p.40) is used to explain how family support might influence self-care behaviours in diabetes. SCT considers how a person's perception of the environment influences their behavior, and their perception of support from

the family. Barriers, obstacles to adherence such as competing demands, social pressures, scheduling, economics, and other factors (Glasgow 1994, cited in Wen et al. 2004) may create barriers to adherence, by creating competing demands, increased social pressures, difficulties with scheduling, economical concerns, and other factors (Baranowski et al. 1997, cited in Wen et al. 2004).

Maillet et al. (1996, cited in Gallant 2003) pointed out that the family is both a support and impediment to diabetes management with respect to diet. In general, spouses were supportive, but participants sometimes felt restricted by family concern about their eating habits. Dietary needs of the diabetic are often secondary to dietary preferences of other family members. Overall, family and peer support have been identified as significant influences on overall diabetes self-care and on diabetes dietary adherence (Gallant 2003).

A study by Corabian and Harstall (2001) highlighted the social-environmental context and includes the web of organized, emotionally based, interpersonal ties within which patients organize the experiencing of diabetes and manage their current living situation, social support, practices of the health care organizations, health insurance status, time, cost and location of the therapeutic regimen, community resources to support diabetes care and education, and safety of the environment, all which potentially have a great influence on diabetes self-management behaviors. Findings include: (1) Concerns about managing other stresses (such as unemployment, financial problems, illness or death in the family, or marital breakdown) and life commitments may compete with recommendations for diabetes self-management behaviors. Patients often attend to the family members' concerns before meeting their own diabetes self-management needs. (2) Support from family and close social networks (including friendship networks) has also been identified as an important factor. How the family is structured, its beliefs, and problem-solving skills, and its patterns of emotional interactions have been shown both to enhance diabetes self-management and to exacerbate the stresses associated

with it. Patients who have both family support and the support of friends show improved self-care behaviour. How well local organizations operate the diabetic education programme, and the level of support given to participants will achieve patient engagement with the programme. When family members, social groups and community members are included in the instigation and operation of the diabetes programmes, social support measures are enhanced for the patient (Corabian et al, 2001).

Wu and Pender (2002) examined the relationships among interpersonal influences, behavior-specific cognitions, competing demands, and physical activity among 832 Taiwanese adolescents. The results indicated that perceived self-efficacy was the most important predictor of physical activity. Interpersonal influences, when considered in total, had a weak and non-significant direct effect on physical activity but had indirect effects on physical activity thorough perceived benefits and perceived self-efficacy. In contrast, peers did have a significant direct effect on physical activity and also indirect influences on physical activity through perceived self-efficacy (Wu & Pender 2002).

Seo and Hah (2004) studied the factors influencing health promoting lifestyle in the elderly. The study's conclusion was the factors influencing a health promoting lifestyle for elderly were prior related behavior, perceived benefits of action, perceived self-efficacy, commitment to a plan of action, and interpersonal influences.

Situational Influences

Situational influences on health-promoting behaviour include perceptions of options available, demand characteristics, and aesthetic features of the environment in which given behaviour is proposed to take place. In the revised HPM, situational influences have been reconceptualized to directly and indirectly influence health. In HPM studies reviewed, 56% reported situational

influences as significant predictors of health-promoting behaviour (Pender 2006, pp.55-56). Pender (2002) outlined how situational influences have received moderate empirical support as determinants of health behaviour and may be an important key to developing new and more effective strategies for facilitating the acquisition and maintenance of health-promoting behaviour in diverse populations. This is important as it helps to explain the importance of the environmental factors that may impact on patient learning.

The Stuifbergen and Becker (1994) study examined 117 adults with disabilities in an effort to explain the occurrence of health-promoting behaviors based on Pender's (1987) Health Promotion Model. The result showed participants were more likely to engage in a health-promoting lifestyle if they had higher specific self-efficacy for health behaviors, higher general self-efficacy, and a wellness-oriented definition of health. They suggested that interventions aimed at enhancing health promotion behaviors would strengthen perceived ability, particularly the ability to successfully carry out health-promoting behaviors.

Kelly et al. (1991) examined 215 patients undergoing a prospective trial of health promotion in a primary care medical practiceto test dimensions of health beliefs, social support, and self-efficacy. Their findings strongly suggest that motivation is a very important intervening variable when evaluating health promotion and resulting behavior change.

Behavioural Outcome

Health promotion behaviour includes: (1) Immediate competing demands and preferences; (2) Commitment to a plan of action.

Immediate Competing Demands and Preferences

Immediate competing demands or preference refer to alternative behaviours that intrude into consciousness as possible courses of action immediately prior to the intended occurrence of a

planned health-promoting behaviour. Both competing demands and preference can derail a plan of action. In the HPM, competing demands and preference are proposed as directly affecting the probability of occurrence of health behaviour as well as to moderate the effects of commitment. Wu (1999, cited in Pender, 2006) tested the effects of competing demands on physical activity behaviour among Taiwanese adolescents. However, he found competing demands were not a significant predicator of physical activity (Pender 2006, p. 57).

Commitment to a Plan of Action

Commitment to a plan of action initiates a behavioural event. In the revised HPM, commitment to a plan of action implies the following underlying cognitive processes: (a) Commitment to carry out a specific action at a given time and place and with specificed person or alone, irrespective of competing preference; and (b) Identification of definitive strategies for eliciting, carrying out, and reinforcing the behavior (Pender et al. 2006, p.56)

The conclusion of the study by Borg et al. (2006) was that life satisfaction in older people with reduced self-care capacity is determined by several factors, with social, physical, mental and financial aspects probably interacting with each other; especially feeling lonely, degree of self-care capacity, poor overall health, feeling worried and poor financial resources in relation to needs. They suggested nursing interventions in terms of preventive home visits, rehabilitation, and health education directed towards physical, psychological, social and economic aspects of importance l may help to preserve or improve life satisfaction for those with reduced self-care capacity.

Ali (1999) scrutinized the impact of health-promoting behaviors and hormone therapy self-efficacy on QOL. The sample contained 210 women between the ages of 45 and 84 years of age. The majority of the participant's perceived moderate satisfaction with their life as a whole,

performed many health-promoting behaviors, and perceived slight confidence in their ability to continue hormone therapy.

2.6 The different lifestyle of ethnic groups and its impact on quality of life

Having a different ethnical background and culture means that health understandings and practices vary, including the interpretation of symptoms, patterns of help seeking, and habits and practices for coping with disease (Chesla et al. 2005). Most health research of ethnic groups is epidemiological and highlights differential rates of morbidity and mortality. However, this phenomenon has not been matched by research on Type 2 diabetes within Aboriginal people and non-Aboriginal people in Taiwan. Few studies of the Aboriginal people's lifestyle have been described. The Central News Agency (CNA) (2004) identified that Taiwan's indigenous people as a whole belong to the Austronesian-language group, whereas, non-indigenous people belong to the Chinese-language group. Aboriginal people in Taiwan are increasingly threatened by diabetes because of their genetic character and changing lifestyles, particularly eating habits. Diabetes has reached an alarming 8 %, higher incidence than the average for non- Aboriginal citizens, and is expected to increase to around 10 % within a few years, particularly if preventative measures are not taken in time. Alcohol abuse and mental illness are two of the other serious problems facing Aborigines in Taiwan. Further, a recent study showed that alcohol consumption may be linked to poorer compliance with diabetic patients (Johnson et al. 2000). Thus, the ethnic variable involved in health education research cannot be ignored. Therefore, this study explored how Aboriginal culture and lifestyle affect health issues of older, similar aged Indigenous and non-Indigenous adults in Taiwan.

In Taiwan, Taiwanese non-Aborigines make up 98% of the country's population. Most of the people are of Chinese origin (70% Fukienese, 20% Hakkas, and 8% Mainlander from other provinces of China). The ancestors of Fukienese and Hakaas came from Fukien and Canton

provinces in China, respectively, and migrated to Taiwan during the 17th century (Chen et al. 2001). The other 8% of people came from the provinces of China when most of them migrated to Taiwan in 1949, after the Civil War. Aborigines trace their origin to the Austronesians, who migrated to Taiwan from Southeast Asia thousands of years ago (Horng 1990, cited in Chen et al 2001). There are 13 Aboriginal groups, together comprising approximately 474919 people, which accounts for about 2% of Taiwan's population. The majority of Taiwanese Aboriginal people are Amis (166769) people followed by Atayal (79024) people (Wikipedia, 2007). The Aborigines have a unique culture, traditional religion and customs, that are all very different from Taiwanese non-Aboriginal people (Chen et al. 1997).

The Taiwanese Aboriginal health status is worse than that of the Taiwanese non-Aboriginals (Chen et al. 2001). Li (1997, cited in Chen et al. 2001) pointed out that Aborigines tend to live in remote mountainous areas, and are often manual laborers who live in relatively poor conditions. In 1997 the average income was only one-third of the national average (Chen et al. 2001). This information may go someway to providing insight into how different cultural and socioeconomic circumstances impact on the development of diabetes mellitus in Aboriginal populations. However, the fact that most of the Aboriginal Taiwanese live in rural areas is also significant for health outcomes.

Taiwan's government implemented policies to promote health care services in mountainous townships. Health care services and clinics were set up in every township in Taiwan. Health rooms were also set up in remote villages to offer outpatient services and health care services (The republic of China yearbook-Taiwan 2002). However, regardless of these attempts to strengthen health services in rural areas, provision of primary health services in rural Taiwan are still lacking. In an attempt to meet the need of communities, public health centres and health rooms have been established. Regardless of the government's efforts, the isolation factor

associated with rural regions and their ability to promote a healthy lifestyle may still be limited (Wang, 1999). Taiwan adopted a National Health Insurance (NHI) program ten years ago and uses International criteria as the foundation for assessment of its performance. Since Chinese migration, Taiwanese indigenous people decreased dramatically to approximately 1.8% of the total. There are 70% Taiwanese Aborigines currently living in rural aboriginal townships who generally remain in remote areas. The degree of good health of the indigenous population has often been used to assess NHI, inclusive of both minority and majority populations (Chang 2005).

The government piloted an Integrated Delivery System (IDS) in 1999, in an attempt to better service people and communities in remote mountain regions. It has since been expanded to include communities on remote islands. The IDS aims to coordinate medical service delivery by contracted providers and local health authorities, especially those who work with indigenous peoples. As a result of this initiative, access to care in remote areas has greatly improved (Chang 2005).

One study found overall mortality of Aborigines in mountainous townships was approximately 70% higher than the respective male and female general population over the past 30 years. Mortality rates were higher from infectious disease, cirrhosis of the liver, accident, and suicides (Wen et al. 2004). In addition, other reports show that regardless of ethnicity, hypertension, heart problem, back pain and arthritis were some of the most prevalent chronic conditions among the elderly (Tung 2004).

A study by Wu (2003) pointed out that Aboriginal men die on average 10 years younger than non-Aborigines in Taiwan. According to the Aboriginal Council Chairman, Chen, “A good number of the Aboriginal people live in distant mountainous areas and, due to inconvenient transportation, they usually suffer from a lack of medical resources and information” (Wu 2003

p.2). As well as demonstrating the low life expectancy of Aborigines, the study by the Cabinet-level Council of Indigenous Peoples and Taiwan Epidemiology Association (TAE) showed that Aboriginal people still have poorer access to medical resources than the average Taiwanese. And their survey, based on data collected in 2001, showed that the life expectancy of Aboriginal men was 63 years, compared with 73 for non-Aborigines, and Aboriginal women lived to 73, compared with 79 for non-Aborigines. Aborigines had a birth rate of 1.544 percent and a death rate of 0.758 percent, while for non-Aborigines the figures were 1.165 percent and 0.571 percent, respectively (Wu 2003). A recent study showed the life expectancy for Taiwan as a whole as 73 years for men and 79 for women, but the figures for mountain areas are 62 for men and 72 for women.; the number of people dying from the ten major causes of death in mountain areas is 55%; the proportion of people dying because of accidents is three times higher in mountain areas as for Taiwan as a whole; the death rate from tuberculosis in mountain areas is 6.5 times as high in mountain areas as for Taiwan as a whole (www.abohome.org.tw/eng/modules/news/index.php?storytopic=6 - 11k.) These alarming statistics indicate that accessibility to health services is reduced in rural areas with a significant resulting impact on the rual dwellers.

Wu (2003, p. 2) was cited as saying, “A shorter lifespan and a higher death rate show that the public health system still needs improvement as far as the Aboriginal tribes are concerned”. These unfortunate statistics are the result of poor access to medical services, the fact that tribal people often let health conditions become so severe they must be admitted to hospital before they seek help, and preventive medicine being seen as an alien concept in the remote villages. Moreover, Wu (2003) also explained that those who die from accidents, drug abuse, alcoholism and other lifestyle-related diseases have a tendency to use the national health insurance services less than average people. It has been claimed therefore that these differences in the health

condition, diseases and medical resources of Aborigines compared with the rest of society requires urgent redress through government policy (Chen 2005).

Although Taiwanese Aborigines have a relatively bad health status, there is evidence that living at high altitudes for the short term can significantly improve glucose tolerance. High altitude living condition and activities may be developed as potential natural medicines for the prevention and treatment of Type 2 diabetes mellitus in the future (Lee et al 2003).

2.7 Summary

In summary, the main findings from the review of the literature are that diabetes is a significant health problem that disproportionately effects the elderly and the Indigenous people of Taiwan; education programs that focus on behaviour changes, especially related to diet, exercise and regular monitoring of blood glucose levels are an effective way to bring about better patient outcomes; education programmes are influenced by many factors; and, the Pender Health Belief Model is a useful theoretical framework for understanding diabetes education and its implementation.

The next chapter describes the research approaches and methods used in the study. It includes an introduction, followed by sections on research design, the intervention method, research setting, sampling, procedure for data collection, data collection protocol, pilot study, instruments used in the study, data analysis techniques and ethical considerations.

CHAPTER 3: RESEARCH DESIGN AND METHODS

3.1 Introduction

This chapter presents the methods and procedures used in this study. Details of the research design, description of the population and sample selection, procedures for data collection, the pilot study, instrumentation, data analysis, and consent and protection of participants are all described in the following sections. The first of the ten sections provides a general description of the research design. The second section is a discussion of the clinical setting where the data were collected, followed by an introduction of sample selection and recruitment. Section three is a discussion of the participants and sampling procedure which is then followed by a discussion of the data collection protocol. In the fourth section, the study protocol is described and the fifth and sixth sections describe the intervention method and analysis plan for both quantitative data and medical record data, respectively. The eighth section reports the findings of the pilot study. The sample size and data analysis are described in the eighth and ninth sections, separately. Finally, the ethical considerations are described in the tenth section which provides an overview of the protection of human subjects within the research project.

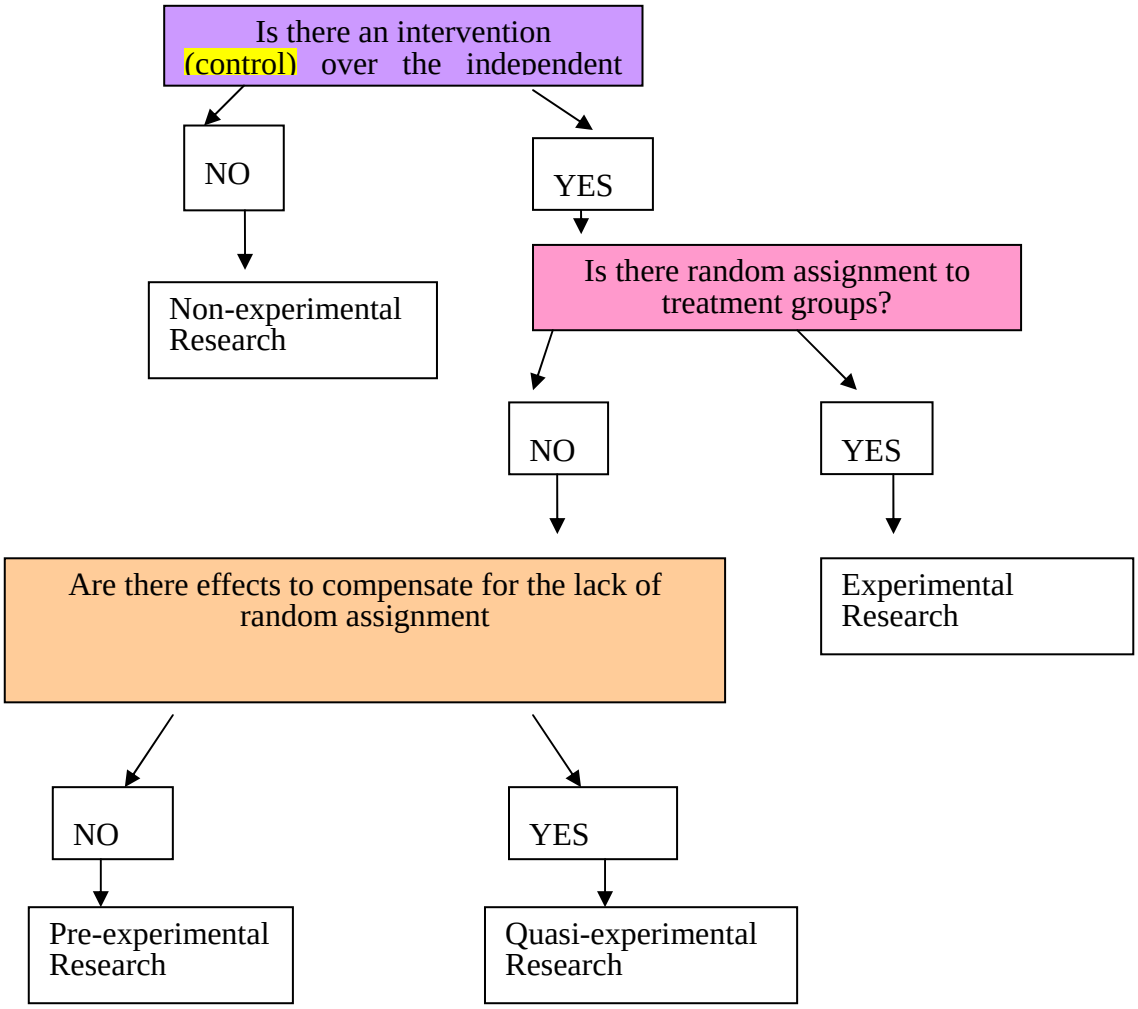
3.2 Research Design

The study examined the effect of a health care package on an individual's knowledge, attitudes, self-care behaviours, and blood glucose control after 3 and 6 months.

Polit and Beck (2004, p.169) explain that "a true experimental design is characterized by three properties: manipulation, control, and randomization." The manipulation involves doing something to study participants. The something, such as experimental treatment or intervention, constitutes the independent variable. Control is achieved in an experimental study by manipulating, by randomizing, by carefully preparing the experimental protocols, and using a

control group. The term control group refers to a group of subjects whose performance on a dependent variable is used to evaluate the performance of the experimental group or treatment group on the same dependent variable. Randomization involves placing subjects in groups at random. Random essentially means that every subject has an equal chance of being assigned to any group. If participants are placed in groups randomly, there is no systematic bias in the groups with respect to attributes that could affect the dependent variable (Figure 3.1). In addition, Polit and Beck (2004) explain that follow-up studies, similar to panel studies, are usually undertaken to determine the subsequent development of individuals who have a specified condition or who have received an intervention. For example, patients who have received a particular intervention or treatment may be followed to determine the long-term effects of the treatment.

Figure 3.1 : Characteristics of different quantitative research designs (adapted from Polit & Beck 2004, p.182)



The follow-up true experimental design is summarized in Figure 3.2.

Experimental group → pretest→intervention → post-test 1→ post-test 2

Control group → pretest ----------→post-test 1→ post-test 2

- Experimental group: Taiwanese Aboriginal and non-Aboriginal older adults.
- Control group: Taiwanese Aboriginal and non-Aboriginal older adults
- Intervention: a health care package.
- Pretest: participants completed a questionnaire and blood was collecrted and measured by the researcher or health station nurses
- post-test 1 and 2: same as pretest

Figure 3.2: Follow-up of True Experiment in Research Design

This study used a cluster random sampling approach. In cluster sampling, the usual procedure for sampling from a general population is to successively sample from administrative units such as state, cities, census tracts, or households (Polit & Beck 2004, p.298).

For matters of feasibility it was impossible to randomize on the individual patient level. Instead, participating health care facilities were randomized into intervention or control (and with them all participating patients) (= cluster randomization). The sample size calculation as well as the statistical analysis was adjusted for the cluster design approach.

3.3 Setting

A total of 30 health care facilities (20 randomly selected local health centres, five private clinics and five regional hospitals) listed with the non-governmental Diabetes Shared Care Networks of Taiwan were approached for collaboration and 12 agreed (6 local health centres, two private clinics and four regional hospitals). The non-governmental Diabetes Shared Care Networks of

Taiwan, established in 1996, is described by Hickman (1994) as a joint participation of hospital consultants and general practitioners in the planned delivery of care for patients with a chronic condition which is informed by an enhanced information exchange that is more comprehensive than the usual routine discharge and referral notes. The successful factors of share care networks include continuity, comprehensiveness and effectiveness (DOH 2007). These 12 health care facilities became the randomized clusters. Health care facilities that declined to participating did so because of administrative requirements which could not be met by the researcher within the timeframe of the study.

The intervention package was distributed in the five public health centres, one private clinic and one regional hospital, including two health centres, one private clinic and one regional hospital that were set up in each township and three health centres that were set up in remote villages in Taiwan. Most diabetic patients in the health centres, private clinics and regional hospitals visit their physician regularly, at least once every one to three months. Patients who attend the health centres, private clinics and regional hospitals are referred by physicians from other medical centres. Colleagues, including four physicians, ten nurses, six staff of the Bureau of Public Health of Hsinchu City, six nurses and two dieticians, collaborated in the study.

3.4 Participants and sampling procedure

The population studied was the clientele with Type 2 diabetes who attended the participating health care facilities. Patients were invited to participate if they fulfilled the following inclusion criteria:

1. Aged 50 years or older (the agreed definition for elderly in Taiwan)
2. Diagnosed as having Type 2 diabetes (ICD-9: 250) or poor blood glucose control over 140mg/dl/AC or 200mg/dl/PC for the past three months.

3. Had been treated in the clinic for more than three months.
4. Had functional cognitive-mental status, could express themselves well, and had no obvious signs of mental disease.
5. No serious disease or diabetic conditions that may confound diabetic control or HbA1c value such as acute infections, surgery, renal disease, liver dysfunction, and low hemoglobin.
6. Males and females were included.
7. Spoke or understood Mandarin or Taiwanese language.

A list of potential subjects was provided by public health centres, private clinics and regional hospitals in Taiwan. Two of these public health centres were situated in Aboriginal communities in Central and Northern Taiwan, and four were situated in non-Aboriginal communities in Central and Northern Taiwan.

Originally, 560 patients of the participating health care facilities were considered eligible; 560 people who had been diagnosed with diabetes yet had not developed any severe complications. They also had visited a public health centre, private clinic or regional Hospitals (In Taiwan, hospitals have four level: 1. medical centre, 2. regional hospital, 3. local hospital, 4. private clinic) in 2004 and 2005. The first stage of the research entailed the researcher assessing the eligibility of 560 participants for enrollment in this research. In total 40 participants were excluded, including two persons who did not meet the inclusion criteria and 38 persons who declined to participate.

In the second step, of the 520 participants, 260 persons were allocated to the intervention group and 260 persons were allocated to the control group through their affiliation with the health care facilities (cluster randomization). However, the intervention group was 19 persons fewer as

these people were too busy to further participate. On the other hand, the control group had one person who was not allocated to the control group because blood data had not been completed.

The third step involved the researcher following-up the participants after three and six month periods. The intervention group had six participants lost to the follow-up because they were too busy to answer questionnaire. In addition, the control group also had nine participants lost to follow-up because seven persons died and two persons became too busy to answer the questionnaire. This resulted in a total of 235 participants in the intervention group and 250 participants in the control group who completed the follow-up questionnaire (see Figure 4 on page 167).

3.5 Study protocol

Letters describing the study and seeking permission for the investigator to telephone the potential participants were mailed from the above local health centres, private clinics, and regional hospitals' outpatients to randomly selected persons (selected at random from data bases by a computer program) who met the sampling inclusion criteria. Each letter also contained a postcard so persons who were willing to be contacted could return the postcard and consent form to the investigator (see appendix C and D). After oral agreement, baseline questionnaires were mailed, and were either returned by mail after completion (n = 35) or were completed during a face-to-face interview with the researchers in case participants requested help (n =465). Follow-up questionnaires were handed out to the participants during their three monthly medical check-up at the health care facilities. Again most questionnaires were completed during a face-to-face interview with the local nurse. There were ten nurses involved in the study and these nurses were previously trained by the researcher to ensure consistency in the data collection process.

3.6 Intervention method

Both intervention and control participants received an information booklet on diabetes. Participants in the intervention group were additionally asked to attend a one hour diabetes education session every week for three weeks. In the first week, patients learnt general information about diabetes mellitus (introduction to diabetes, signs and symptoms, treatments, hyperglycemia and hypoglycemia, and complications). In the second week patients were familiarized with specific dietary suggestions (diabetes and meal planning: a healthy diet, six food groups, how much is a serving of starch, what are healthy ways to eat starches, how much should you eat each day and how to control your body weight). In the third week patients were educated about the self-care requirements of diabetes (home care of diabetes: exercise plan, medicine management, self-monitoring of blood glucose, foot and wound care, preparing to travel with diabetes and introduction to support systems in Taiwan). The information presented was based on available and valid educational material about Type 2 diabetes (www.nlm.nih.gov/medlineplus/tutorials/diabetesintroduction/htm; DOH booklet 1990, 2005; www.hichannel.com.tw). The educational material was delivered in several ways including formal lecturing, role play, as well as practice and experience sharing to enhance the learning ability of older people. All educational interventions were delivered within the settings of the participating health care facilities. The educational interventions were delivered to six groups of participants ranging between 25 and 70 in size.

Detailed description of Patient Diabetic Education Programme

Following is a detailed description of the educational intervention as delivered to the intervention group in the study.

First week: Diabetes introduction programme design (1 hour)

Programme objects	Context	Teaching methods/materials
1. participants can say three signs and symptoms of Type 2 diabetes at least 2. participants can say the cause of Type 2 diabetes at least 3. participators can say three complications and complication signs of Type 2 diabetes at least 4. participant can say three policies to control Type 2 diabetes and can say two signs of hyperglycemia and hypoglycemia at least.	1. Introduction 2. What is Diabetes? 3. Signs & Symptoms 4. Treatment Options 5. Controlling Diabetes 6. Hyperglycemia and hypoglycemia 7. Complications 8. Summary	1.Lecture teaching 25 mins, showed powerpoint /computer, microphone 2. Group discussion 15 mins, 8-10 person for each group/microphone. 3. Experience sharing 15 mins /microphone. 4. Conclusion 5 mins /microphone.

Context Details

1. **Introduction**

Diabetes is a disease that affects many of Taiwanese people every year. Our doctor may have informed you that you have diabetes. Although there is no known cure for diabetes, there are several treatments, which can control this disease. The success of any diabetes treatment depends largely on you, the patient. This patient education will help you develop a better understanding of diabetes and how to control this disease.

2. **What is Diabetes?**

The body is made of millions of cells that need energy to function. The food you eat is

turned into glucose, called glucose. Glucose is carried to the cells through the blood stream. It is one of many substances needed by the cells to make energy. Insulin is a chemical hormone, which is manufactured in the pancreas. Insulin levels in the blood vary with the amount of glucose present in the blood. Type 2 diabetes occurs when insulin is present in enough quantities, but there is a decrease in the number of receptors on the cells to allow glucose to enter. Even though insulin is present, it cannot be used effectively, a situation called “Insulin Resistance” which results in high levels of glucose in the blood. The exact causes of diabetes are unknown. However, it trends to run in families. Diabetes is not a contagious disease. Diabetes is detected when your doctor or nurse finds a high level of glucose in your blood or urine. The most reliable test results are obtained when the glucose level in the blood is checked before any food or liquid is ingested. This is known as a fasting blood glucose. A range for a normal fasting blood glucose is between 70mg/dl and 120mg/dl.

3. Signs and Symptoms

Common signs and symptoms of diabetes include:

1) Excessive thirst, frequent urination

2) Excessive hunger, weight loss

3) Fatigue, changes in vision

4) Slow-healing cuts or infections persistent itching of skin

5) If left untreated, the level of glucose in the blood can become very high, inducing coma and possibly death.

4. Treatment Options

Patients with Type 2 diabetes may not need insulin. Diabetes in these patients is typically controlled with diet and exercise. Sometimes oral medications are also prescribed. In some cases of Type 2 diabetes, insulin may also be required.

5. Controlling Diabetes

You can control diabetes by:

1) Eating right

2) Exercising

3) Monitoring your blood glucose level

4) Taking prescribed medications

5) Learning about diabetes

Your dietician or diabetes educator will explain how you can plan your meals and answer any questions you may have about nutrition. The three goals of eating right are:

1) Controlling your weight

2) Keeping the level of blood glucose at normal levels

3) Reducing fat in the body

A healthy diet may include changing what you eat, how much you eat, and how often you eat. However, you may be surprised by how many healthy and tasty food options you have.

Exercise helps diabetic patients in many ways. It lowers glucose levels, helps weight-loss, and maintains a healthy heart and circulation. In addition, exercising helps relieve stress and strengthen muscles. Your healthcare team will discuss with your doctor before starting a new exercise programme.

Blood glucose testing is important in order to find out if your blood glucose level is where it should be. If your blood glucose is too low or too high, you may need a change in your diabetes medication, diet, or exercise plan. If a change is needed, you doctor or

diabetic care team will give you instructions on what you should do. Your blood glucose level is determined by testing a small drop of blood obtained from one of your fingers. This drop of blood is blood obtained by sticking your finger with a lancet. Blood glucose is usually checked one to four times each day. This can be done at home. Most diabetics become very competent at checking their own blood glucose.

In case of very high blood glucose levels that do not respond to diet and exercise plans, medications may be needed. Your doctor will tell you if you need medications or insulin. If insulin is needed, it can only be injected. Insulin is needed for all patients with Type 1 diabetes and some patients with Type 2 diabetes.

6. Hyperglycemia and Hypoglycemia

When controlling your diabetes, your blood glucose can become too high or too low. These conditions should be taken seriously. Fortunately, you can regain control of your blood glucose.

When too much glucose is in your blood, this condition is called hyperglycemia. Hyperglycemia is caused by eating too much food, eating glucose, sweet foods, or by not taking your medication. It can also happen when you are sick. If not treated, hyperglycemia can cause you to go into a coma. Signs of high blood glucose, or hyperglycemia, include: (1) Dry mouth, thirst; (2) Frequent urination, blurry vision.

When you have high blood glucose, you should drink water or other glucose-free liquids. Check your blood glucose and stick to your diet plan. If your blood glucose remains high, call your doctor. Your doctor will tell you what is considered high for you. If the blood glucose level is what has been outlined as high for you, you may need to go to the hospital.

Hypoglycemia occurs when too little glucose is present in your blood. Hypoglycemia usually occurs with patients who take insulin or other medications. It can be caused by taking too much insulin. That is why it is also known as insulin shock. It can also be caused when you decrease your food intake or skip a meal, or when you exercise more than usual. Signs of high blood glucose, or hypoglycemia, include:

1) Sweating, shaking, nervousness
2) Hunger, dizziness, faintness
3) Pounding heart, personality change, confused thinking, impatience, crankiness.
4) Numbness of lips and tongue, headache, blurred vision, and slurred or slowed speech.

If not treated, low blood glucose can lead to fainting or seizures. Some patients however do not experience any signs when their blood glucose is low. These patients must depend on blood glucose testing to find out if they have hypoglycemia. If you have low blood glucose, immediately eat or drink something contain fast-acting glucose. Examples include any of the following: half a cup of fruit juice, regular soda pop, ten gumdrops, two teaspoons of glucose or honey. If your symptoms do not disappear in 15 minutes or your blood glucose remains less than 80mg/dl, take another dose of fast-acting glucose. Repeat every 10 to 15 minutes until the blood glucose is greater than 80. If it is less than 30 minutes until your next meal, eat that meal. If it is more than 30 minutes, eat a snack such as half a meat sandwich. Eat the meal or snack after you have taken a dose of fast-acting glucose. Do not subtract the snack from your next meal plan. Do not drive or operate equipment if you feel your blood glucose is low. You should inform your family members and friends that you are diabetic and that if they ever find you unconscious or not making sense, they should take you to a hospital immediately or call “119”.

7. Complications

When you control the level of glucose in your blood, the signs of diabetes become less frequent. You will feel better and have more energy. If you do not follow your diet, exercise, and perform glucose level tests, serious complications can arise. Complications of diabetes include damage to the nerves and blood vessels of the body, such as diabetic nerves going to the legs and feet. The feet or legs could feel numb or unusually cold. People with diabetes who have poor sensation in their feet must be very careful to avoid damaging their feet with ill-fitting shoes, hot water, or other forms of injury. Sexual dysfunction can also occur. In men with diabetes, the most common problem is impotence due to damaged nerves going to the sexual organs. Urologists can help treat impotence with surgical and non-surgical treatments. In women with diabetes, damaged nerves in the pelvic organs and genitals can lead to impaired sexual arousal and painful intercourse. If this occurs, your doctor can recommend a treatment. Fat in the blood is deposited on the walls of blood vessels. This causes hardening of the arteries or arteriosclerosis, a further complication of diabetes. Your diet plan is designed to lower the level of fat and cholesterol in the blood. The thickening of small blood vessels is most noticeable in the kidney and in the back of the eye. When the small vessels in the back of the eye thicken, blood may leak into the inside of the eye or vitreous fluid. This causes the vitreous fluid to become cloudy. If not treated, this condition, also known as diabetic retinopathy, can lead to blindness. Your eye doctor can help recommend treatment for this condition. In addition, proteins that should stay in the body may leak into the urine. Your doctor can test for small protein in your urine to determine if there are early signs of kidney diseases.

People with diabetes kidney disease often develop high blood pressure. It is very important that the blood pressure be treated with blood pressure lowering medicines because this helps to prevent worsening of the kidney problems. If you have diabetic kidney disease, your doctor may also prescribe a special diet that is low in protein and restricted in salt. In rare cases, dialysis and even kidney transplants may become necessary.

8. Summary

Diabetes management consists of:

1) Following a diet plan

2) Testing blood glucose

3) Exercising

4) Taking any prescribed medication on time

5) Ensuring good hygiene

6) Learning about diabetes

Your doctor, nurse, and dietician will explain to you your specific diabetes control plan. When you follow these instructions, the possibility of experiencing the problems of diabetes discussed in this programme can be significantly reduced. This patient education lesson is made available to you by your healthcare team to help you enjoy a healthier lifestyle while controlling diabetes.

* **Second week: Diabetes and Meal planning (1 hour)**

Programme objects	Context	Teaching methods/materials
1. Participants can say three goals of diabetes diet control 2. Participants can say eating habit principle of diabetes diet control 3. Participants can say "what's balance diet 4. Participants can say six food groups	1. Diet and diabetes 2. Consider how much you eat 3. Food groups 4. The pyramid 5. Blood glucose 6. Summary 7. Teaching cook methods by diabetes cooking book	1.Lecture teaching 20 mins, showed powerpoint/computer , microphone 2. To demonstrate cooking 30mins /microphone, a microwave oven, some fresh food such as eggs, milk 3. Conclusion 5 mins /microphone.

Context Details

1. **Diet and diabetes**

A healthy and balanced diet is very important for everybody, but even more so far people with diabetes. You can control your blood glucose successfully if you

1) Maintain an optimal weight

2) Pay attention to what you eat

3) Consider how much you eat

2. **Consider how much you eat**

For persons with Type 2 diabetes, diet and lifestyle changes can control blood glucose so well that for some patients, medication is not needed. The body constantly

uses energy to keep itself at a normal temperature and to carry out bodily functions. Energy is measured in calories. A “calorie” is a unit of energy that is made available to body by the food we eat.

The amount of calories that a person needs depends on their age, size, level of activity and metabolism. A large person needs more calories than a small person because a bigger body needs more energy than a smaller body. People of approximately the same age, size, and activity level may require a different amount of calories per day, because some people naturally burn more calories than others.

Medical conditions can also affect metabolism. For example, a person with a thyroid gland that does not secret enough thyroid hormone will have a slower metabolism.

When a person eats more calories than they need, the extra calories are stored in the fatty tissues of the body and can lead to increased weight. When a personal eats fewer calories than they need, the body burns fat to supply the needed calories and the person loses weight.

One way to control glucose levels is to keep body weight as close as possible to an ideal weight. Your doctor and registered dietician can help you to know your ideal body weight. After determining your ideal body weight, they can help you figure out how many calories you need in one day. People who are 20% heavier than their ideal weight are medically “obese.” To reduce weight, they should eat fewer calories than their body needs.

3. Food groups

Food is commonly divided into the following 6 food groups.

- Fat and cholesterol

- Proteins
- Carbohydrates
- Vitamins
- Minerals
- Fibres

Too much fat and cholesterol in the blood can lead to blocked arteries in the heart and brain, as well as other organs. Blocked arteries very often lead to heart attacks and strokes.

1 gram of fat = 9 calories. Carbohydrates and protein only have 4 calories per gram. Less than 30% of your total calories should come from fat.

1 gram of carbohydrate = 4 calories. 50-60% of total calories should come from carbohydrates.

1 gram of protein = 4 calories. No more than 10-20% of calories should come from protein.

The body cannot make vitamins and minerals; we have to consume from. Without enough vitamins and minerals, the body could contract serious disease.

Common vitamins include: vitamins A, B, C, D, and K.

Common minerals include: Salt, Potassium, Calcium and Iron.

Fibre is mainly found in non-animal products, such as vegetables and fruits.

4. A healthy diet

A healthy diet is a diet that provides the nutrients your body needs in sufficient amounts. Different people need different amounts of calories. Here are 6 general guidelines that apply to all people and more importantly, to diabetics.

1) Eat a variety of foods

2) Eat the amount of food your body needs

3) Eat a lot of grain products, vegetables, and fruits.

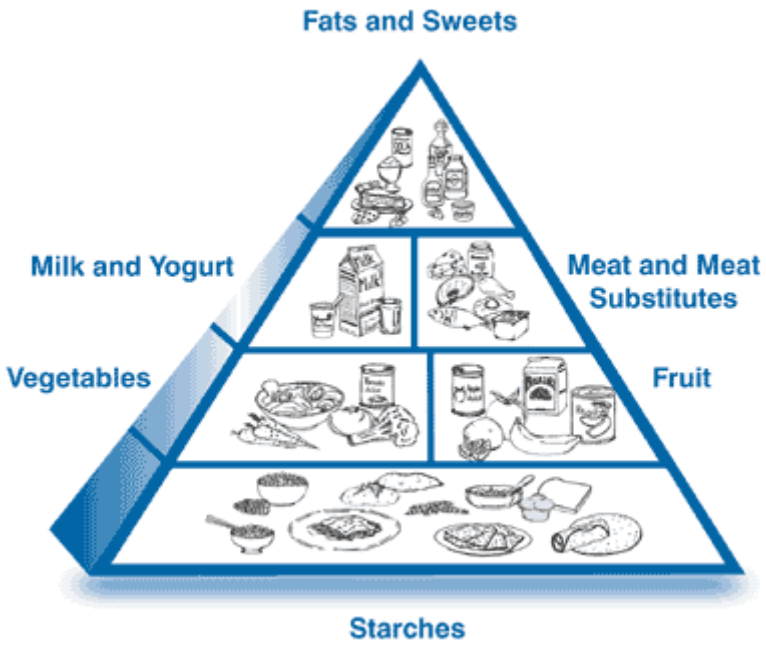
4) Eat a diet low in fat and cholesterol

5) Choose moderation for certain foods and drinks.

6) Refrain from smoking.

5. The Pyramid

The Food Pyramid is a guide for healthy eating that suggests eating daily a variety of food while eating the appropriate amount from each group of food in the first 3 levels. One the 1st level are the complex carbohydrates that make up most of the calories you consume in a day. On the 2nd level are the dairy products, meat, eggs, and nuts. At the very top are the fats, oils, and sweets. It is not important to eat these every day!



Eat a variety of food to get the vitamins and minerals you need. Eat more from the groups at the bottom of the pyramid, and less from the groups at the top.

Measuring Your Food

To make sure your food servings are the right size, use

- measuring cups
- measuring spoons
- a food scale

Also, the Nutrition Facts label on food packages tells you how much of that food is in one serving.

Weigh or measure foods to make sure you eat the right amounts.

These tips will help you choose the right serving sizes.

- Measure a serving size of dry cereal or hot cereal, pasta, or rice and pour it into a bowl or plate. The next time you eat that food, use the same bowl or plate and fill it to the same level.
- For one serving of milk, measure 1 cup and pour it into a glass. See how high it fills the glass. Always drink milk out of that size glass.
- Meat weighs more before it's cooked. For example, 4 ounces of raw meat will weigh about 3 ounces after cooking. For meat with a bone, like a pork chop or chicken leg, cook 5 ounces raw to get 3 ounces cooked.
- One serving of meat or meat substitute is about the size and thickness of the palm of your hand or a deck of cards.
- A small fist is equal to about 1/2 cup of fruit, vegetables, or starches like rice.
- A small fist is equal to 1 small piece of fresh fruit.
- A thumb is equal to about 1 ounce of meat or cheese.
- The tip of a thumb is equal to about 1 teaspoon.

* **Third week: Diabetes self care (1 hour)**

Programme objects	Context	Teaching methods/materials
1. Participants can say three goals of diabetes control 2. Participants can say how to care for themselves and their feet 3. Participants can say "how to control blood glucose" 4. Participants can say how to care for themselves at home	1. The importance of Exercise plan 2. YourDiabetesMedicines 3. Self care for diabetes 4. Healthy feet 5. How to prepare travel for diabetes? 6. Support System of diabetes patients	1.Lecture teaching 30 mins, showed powerpoint/ computer, microphone 2. To demonstrate exercise 10mins /microphone, a table and a chair 3. To demonstrate foot care 15min / a washbasin, a towel, a soap, a bottle lotion, a pair shoe 4. Conclusion 5 mins/ microphone.

Context Details

i. The importance of exercise plan

What you eat and when also depend on how much you exercise. Exercise is an important part of staying healthy and controlling your blood glucose. Physical activity should be safe and enjoyable, so talk with your doctor about what types of exercise are right for you. Whatever kind of exercise you do, here are some special things that people with diabetes need to remember:

- Take care of your feet. Make sure your shoes fit properly and your socks stay clean and dry. Check your feet for redness or sores after exercising. Call your doctor if you have sores that do not heal.

- Drink about 2 cups of water before you exercise, about every 20 minutes during exercise, and after you finish, even if you don't feel thirsty.

- Warm up and cool down for 5 to 10 minutes before and after exercising. For example, walk slowly at first, and then begin to walk faster. Finish up by walking slowly again.

- Test your blood glucose before and after exercising. Do not exercise if your fasting blood glucose level is above 300. Eat a small snack if your blood glucose is below 100.

- Know the signs of low blood glucose (hypoglycemia) and how to treat it.

ii. Your Diabetes Medication

What you eat and when affects how your diabetes medications work. Talk with your doctor or diabetes educator about the best times to take your diabetes medication based on your meal plan. What you eat and when affects how your diabetes medicines work. Talk with your doctor about the best times to take your diabetes medicines based on your meal plan. The side effect of diabetes medications includes: edema, hepatitis, stomach upset such as flatus, nausea and diarrhea.

- The kinds of diabetes medications: oral or injectable insulin

Who cannot take diabetes medication?

- Type 1 diabetes patients
- An expectant mother or lactation of diabetes women.
- The patient who is planned for a large surgical operation.
- The patient who has serious stress.
- The patient who has serious side effects of oral diabetes medication.
- The patient who has heart failure, or complications of the liver or kidney.

- If mix use RI and NPH, we need to siphon RI and then to siphon NPH. After mix them, using it as soon as possible.

- To change injection side every day.
- To check your urine glucose or blood glucose: Best to be done before meal and sleeping

iii. Healthy feet

Do you want to avoid serious foot problems that can lead to a toe, foot, or leg amputation? Take Care of Your Feet for a Lifetime tells you how. It's all about taking good care of your feet. Foot care is very important for each person with diabetes, but especially if you have:

- Loss of feeling in your feet.
- Changes in the shape of your feet.
- Foot ulcers or sores that do not heal.

Nerve damage can cause you to lose feeling in your feet. You may not feel a pebble inside your sock that is causing a sore. You may not feel a blister caused by poorly fitting shoes. Foot injuries such as these can cause ulcers which may ultimately lead to amputation.

Keeping your blood glucose (glucose) in good control and taking care of your feet every day can help you avoid serious foot problems.

Use this guide to make your own plan for taking care of your feet. Helpful tips make it easy! Share your plan with your doctor and health care team and get their help when you need it.

Daily foot care and regular care：

You may have serious foot problems, but feel no pain. Check your feet for cuts, sores, red spots, swelling, and infected toenails. Find a time (evening is best) to check your feet each day. Make checking your feet part of your every day routine. If you have trouble bending over to see your feet, use a plastic mirror to help. You also can ask a family member or

caregiver to help you.

Wash your feet every day and take account of the following:

- Wash your feet in warm, not hot, water. Do not soak your feet, because your skin will get dry.

- Before bathing or showering, test the water to make sure it is not too hot. You can use a thermometer or your elbow.

- Dry your feet well. Be sure to dry between your toes. Use talcum powder or cornstarch to keep the skin between your toes dry.

Keep the skin soft and smooth：

- Rub a thin coat of skin lotion, cream, or petroleum jelly on the tops and bottoms of your feet. Do not put lotion or cream between your toes, because this might cause an infection. Put lotion on the tops and bottoms of your feet.

Smooth corns and calluses gently：

If you have corns and calluses, check with your doctor or foot care specialist about the best way to care for them.

- If your doctor tells you to, use a pumice stone to smooth corns and calluses after bathing or showering. Pumice stone is a type of rock used to smooth the skin. Rub gently, only in one direction, to avoid tearing the skin.

Do not cut corns and calluses. Don't use razor blades, corn plasters, or liquid corn and callus removers - they can damage your skin. Gently rub calluses with a pumice stone. Make sure to call your doctor right away if a cut, sore, blister, or bruise on your foot does not begin to heal after one day.

Trim your toenails each week or when needed:

- Trim your toenails with clippers after you wash and dry your feet.
- Trim toenails straight across and smooth them with an emery board or nail file.
- Don't cut into the corners of the toenail.
- If you can't see well, if your toenails are thick or yellowed, or if your nails curve and grow into the skin, have a foot care doctor trim them.

How to keep the blood flowing to your feet：

- Put your feet up when you are sitting.
- Wiggle your toes for 5 minutes, 2 or 3 times a day. Move your ankles up and down and in and out to improve blood flow in your feet and legs.
- Don't cross your legs for long periods of time.
- Don't wear tight socks, elastic or rubber bands, or garters around your legs.
- Don't smoke. Smoking reduces blood flow to your feet. Ask for help to stop smoking.
- Work with your health care team to control your A1C (blood glucose), blood pressure and cholesterol.

Footwear：

Proper footwear is very important for preventing serious foot problems. Athletic or walking shoes are good for daily wear. They support your feet and allow them to "breathe." Never wear vinyl or plastic shoes, because they don't stretch or "breathe." When buying shoes, make sure

they are comfortable from the start and have enough room for your toes. Don't buy shoes with pointed toes or high heels. They put too much pressure on your toes.

You may need special shoes or shoe inserts to prevent serious foot problems. If you have Medicare Part B insurance, you may be able to get some of the cost of special shoes or inserts paid for. Ask your doctor whether you qualify for

- 1 pair of depth shoes and 3 pairs of inserts, or
- 1 pair of custom molded shoes (including inserts) and 2 additional pairs of inserts.

Wear shoes and socks at all times:

- Wear shoes and socks at all times. Do not walk barefoot - not even indoors - because it is easy to step on something and hurt your feet.
- Always wear socks, stockings, or nylons with your shoes to help avoid blisters and sores.
- Choose clean, lightly padded socks that fit well. Socks that have no seams are best.
- Check the insides of your shoes before you put them on to be sure the lining is smooth and that there are no objects in them.
- Wear shoes that fit well and protect your feet.
- Check the inside of your shoes before you put them on:

Protect your feet from hot and cold.

- Wear shoes at the beach or on hot pavement.
- Put sunscreen on the top of your feet to prevent sunburn.
- Keep your feet away from radiators and open fires.
- Do not put hot water bottles or heating pads on your feet.

- Wear socks at night if your feet get cold. Lined boots are good in winter to keep your feet warm.
- Check your feet often in cold weather to avoid frostbite.
- Protect your feet when walking on hot surfaces.

Make sure to call your doctor right away if a cut, sore, blister, or bruise on your foot does not begin to heal after one day.

Preventing injury to the feet:

- Ask your doctor to help you plan a daily activity program that is right for you.
- Walking, dancing, swimming, and bicycling are good forms of exercise that are easy on the feet.
- Avoid activities that are hard on the feet, such as running and jumping.
- Always include a short warm-up and cool-down period.
- Wear athletic shoes that fit well and that provide good support.

Regular checkups

Be sure to ask your doctor to:

- Check the sense of feeling and pulses in your feet at least once a year.
- Tell you if you are likely to have serious foot problems. If you have serious foot problems, your feet should be checked at every visit to your doctor.
- Show you how to care for your feet.
- Refer you to a foot care doctor if needed.
- Decide if special shoes would help your feet stay healthy.

Ask your doctor to check the sense of feeling in your feet.

There is a lot you can do to prevent serious problems with your feet.

Make healthy lifestyle choices to help keep your blood glucose (glucose), blood pressure, and cholesterol close to normal. Doing so may help prevent or delay diabetes-related foot problems as well as eye and kidney disease. Work with your health care team to make a diabetes plan that fits your lifestyle. The team may include your doctor, a diabetes educator, a nurse, a dietician, a foot care doctor called a podiatrist, and other specialists. This team will help you to: Know when to get checks of your A1C,* blood pressure, and cholesterol; how and when to test your blood glucose; take your medications as prescribed; eat regular meals that contain a variety of healthy, low-fat, high-fibre foods including fruits and vegetables each day; get physical activity each day; stop smoking; follow your foot care plan; keep your doctor's visits and have your feet, eyes, and kidneys checked at least once a year; visit your dentist twice a year; regular review of A1C, a measure of your blood glucose over a 3-month period.

Summary

- Begin taking good care of your feet today.
- Set a time every day to check your feet.
- Note the date of your next visit to the doctor.
- Print out the foot care tip sheet and put it on your bathroom or bedroom wall or nightstand as a reminder
- Print out and complete the "To Do" list. Get started now

- Set a date for buying the things you need to take care of your feet: nail clippers, pumice stone, emery board, skin lotion, talcum powder, plastic mirror, socks, athletic shoes, and slippers.

Points to Remember

- What, when, and how much you eat all affects your blood glucose level.
- You can keep your blood glucose at a healthy level if you:
    - Eat about the same amount of food each day.
    - Eat at about the same times each day.
    - Take your medicines at the same times each day.
    - Exercise at the same times each day.
- Every day, choose foods from these food groups: starches, vegetables, fruit, meat and meat substitutes, and milk and yogurt. How much of each depends on how many calories you need a day.
- Limit the amounts of fats and sweets you eat each day.

iv. How to prepare travel for persons with diabetes?

- Double medication dose for travel. Packing these in different places; one in kit and one on the person
- Check glucose machine prior to departure
- Preparing snack for preventing low glucose food.
- Take two pair of comfortable shoes.
- Preparing foot care things

v. Support system for persons with diabetes

- Diabetes patient groups
- A network of diabetes care in common
- http://www.dhp.doh.gov.tw/

vi. Summary

Do not skip meals. Eat something every 4 to 5 hours. No special or diet food are needed. It is the total amount of carbohydrate per meal or snack that matter. Watch the size of the portion

you eat. Choose food lower in total fat especially saturated fat, lower in cholesterol, and lower in sodium. Cooking and eating healthy so you can control your diabetes is not only good for you; it is also good for your family.

3.7 Questionnaire and medical record

Based on the Health Education Model, this study used five questionnaires. Data were collected from two sources: patients self-reported questionnaires and medical records. Participants' medical histories and demographic data were collected from the patient's medical records. The five sections of questionnaires were:

1. Diabetes Personal Data Sheet
2. The Rand Social Health Battery and Social Services
3. The Health perceptions Questionnaire
4. Summary of Diabetes Self-Care Activities (SDACA)
5. Quality of Life (WHOQOL-Brief)

Each item in this survey was examined independently by a panel of expert professionals who specialize in diabetes mellitus: physicians, public health leaders, dietitians, and a counselor (nurse) who had extensive experience in providing diabetes mellitus education to patients. The panel examined both the contents and the responses. Scales regarding relevance were constructed. In addition to the five questionnaires, data from the participants' medical record were also collected.

<u>Section 1: Diabetes Personal Data Sheet</u>

Patient's personal information data collected included demographic data and health status. The researcher modified the Chinese version after receiving permission from Chang et al. (2003) (Appendix A). The demographic data included age, gender, education, ethnicity, occupation,

insurance, and marital status and/or de-facto. Health status includes length of time since diagnosed with diabetes, self-known diabetes co-morbidities and non-diabetes co-morbidities, pharmacological status, and recent blood glucose. Demographic and health status were used to describe the participants in this study. Self-reported biomedical data were compared to medical record data to measure the accuracy of patients' self-awareness of their diabetes medical status.

The diabetes shared care network includes the health care institutions: hospital, private primary care clinic, or public health centre. Diabetes care disciplines include physicians, dietitians, and nurses who are available to provide diabetes care. In addition, the researcher also obtained the Aboriginal public health centre's assistance to carry out the diabetes education package .This diabetes education package was designed by the researcher.

The researcher randomized participants to either an experimental or control group. Participants were asked to respond to questions in regards to personal information, and self-reported biomedical data and researcher got a permit to check participants' medical record data. to include in the study and to assist with the education sessions.

Section 2(1): The Rand Social Health Battery

The Rand Social Health Battery was developed in 1978 alongside the other Rand health measures as an outcome measurement for the Health Insurance Experiment. The Rand Social Health Battery is a questionnaire that measures the social interaction and social supports of the participant. It is a well established scale that has good consistency and reliability (Abdulrehman & De Luca 2001). It does not rate the subjective experience of support. The Rand Social Health Battery is intended for use in general population survey (McDowell & Newell 1996, pp.134-136). This questionnaire includes an 11 item self-report scale that provides for social

resources and social interaction. Social capital includes the number of friends, while social interaction refers to the frequency of interaction with friends. The scale covers home and family, friendships, and social and community life using both open-ended and forced–choice questions. Open-ended questions require the participant to answer with a number such as for the number of friends. The forced-choice questions require the participant to choose from one of several given answers. After this questionnaire is completed, it is recoded to provide an overall score; a higher score indicates more favorable social behaviour (Abdulrehman & De Luca 2001). The Rand Corporation (1978) reports low inter-item correlation for this scale (Kliempt et al. 2000; Abdulrehman & De Luca 2001).

Section 2(2): Social Services

The social service questions were adapted from the "Structured Interview Guide" (Ervin 2004). The questions focused on the family's experiences of using services from various agencies and social services. The interview questions are listed in the Appendix.

Section 3: The Health Perceptions Questionnaire

The Health Perceptions Questionnaire (HPQ) (Ware 1976) is a self-report instrument that records perceptions of past, present, and future health, resistance to illness, and attitude toward sickness. It is a survey instrument that has been used as an outcome measurement in the Rand Health Insurance Experiment (HIE) and as a predictor of use of care. The HPQ contains the 33 items as shown in Appendix. The items form six subscales: current health (nine items), prior health (three items), health outlook (four items), resistance to illness (four items), and health worry/concern (five items), and sickness orientation (two items). Test-retest reliability figures for the GHRI at intervals of one, two, and three years for adults in HIE were 0.66, 0.59, and 0.56. The HPQ was designed to measure six postulated aspects of health perceptions. Factor analyses of data from the preliminary field tests confirmed the existence of six main factors and

indicated that each scale contributed some unique information about health perceptions (McDowell & Newell 1996, pp. 219-220).

Section 4: Summary of Diabetes Self-Care Activities (SDSCA)

The fourth questionnaire is the Summary of Diabetes Self-Care Activities (SDSCA). The SDSCA was selected for this study because simply framed questions requiring selection of a single numeral based on seven-day recall.

The first version of the SDSCA questionnaire was used by Schafer et al. and Glasgow et al. (Toobert et al. 1994). The original SDSCA measure assessed 5 aspects of the diabetes regimen: general diet, specific diet, exercise, blood-glucose testing, foot care, and smoking. It is a brief self-reporting questionnaire of diabetes self-management that includes items assessing aspects of the diabetes regimen (Toobert et al. 2000). The latest version of the SDSCA scale consists of 11 items and 14 additional questions that may be used in the interpretation of the results. These dimensions are diet (4 items), exercise (2 items), self-monitoring of blood glucose (2 items), foot care (2 items) and smoking termination (1 item). The scale includes 2 items that assess general diet and 2 items that assess special diet regimen. The specific diet scale has items that ask about particular eating habits such as eating fruit, vegetables, and high-fat foods, and spacing carbohydrates throughout the day. The scale was calculated for the diet and exercise regimen area using the mean number of days per week on a scale of 0 to 7 (Anderson & Svardsudd 1995; Wen et al. 2004).

The revised SDSCA includes self-care recommendations received from health care providers for each dimension. Although Toobert et al. (2000) recommended excluding the medication scale in the revision due to its tough upper limit effect in previous studies, in the revised SDSCA taking medication are still included related to three items of activities (Chang, 2003).

For each regimen area, items were constructed to measure both absolute levels of self-care behaviour and adherence to individual prescriptions (Toobert et al. 1994).

The SDSCA questionnaire is a brief yet reliable and valid self-report measure of diabetes self-management that is useful both for research and practice (Toobert et al. 2000). The SDSCA is probably the most widely used self-report instrument for measuring diabetes self-management in adults and has been successfully adapted for adolescents with type 1 diabetes. It has also undergone various modifications (Toobert et al., 2000). Recently, Toobert, Hampson and Glasgow (2000) received results from 7 different studies in order to revise the SDSCA scale. Diabetes self-care includes a range of activities. Self-care is multidimensional and it is now well established that these different components do not correlate highly. Results from this study presented the average inter-item corrections within scales were high (mean = 0.47), with the exception of specific diet; test-retest corrections were moderate (mean = 0.40). Correlations with other measures of diet and exercise generally supported the validity of the SDSCA subscales (mean = 0.23).

Using this questionnaire based on the seven-day scale is considered to be appropriate for administration to the diabetes population in Taiwan, with more than 50% of diabetes sufferers having low education levels (Chuang et al. 2001). In addition, older adults may suffer from memory loss. It is easy to remember one week of self-care activities for older adults. The rating categories that use number of days of self-care activities performed within one week is easy to respond to for this population. The researcher in this case modified the SDSCA Chinese version after receiving permission from Chang et al. (2003).

Several studies have used the SDSCA questionnaire in their studies and have demonstrated the reliability and validity of the tool. For example, Chang (2003) modified the SDSCA

questionnaire to test 34 patients in a diabetes pilot study in Tzu-Chi Medical Centre in Taiwan. The α coefficient of internal consistency reliability was .48, .59, .79, and .92, and .50 respectively.

Section 5 :Quality of Life (WHOQOL-Brief)

Quality of life (QOL) is defined in many ways, including a subjective perception of well being which may include a cognitive component, such as satisfaction, and an emotional component, such as happiness (Campbell et al. 1976), or it may be assigned to the duration of life and modified according to the social opportunities, perceptions, functional states and impairments influenced by such factors as disease, injuries, treatments or policy (Patrick et al. 1988), or further, it can be defined by what the patient claims it is, in other words, how the individual perceives quality of life (Joyce 1991). The most effective setting for the assessment of patients' quality of life, which also helps them find their own ways to improve it, is purported to be by way of an individual structured interview or a group discussion with the patients themselves and/or their family (Maldonato et al. 2004).

In this study the World Health Organization Quality of Life Taiwan Brief version (WHOQOL-Brief-TAIWAN) was used to measure patients' subjective perception of quality of life as one outcome indicator of quality of care.

The World Health Organization (WHO) initiated a cross-culture project on the development of the WHOQOL-100 questionnaire in 1991 and finished it in 1995. Finally, the questionnaire was simplified to WHOQOL-BREF containing 26 items, allowing for different cultures or nations to add culture-specific questions (Phungrassami et al. 2004). THE WHOQOL GROUP (1998) identified the WHOQOL-BREF as being derived from data collected using the WHOQOL-100. It produces scores in four domains related to quality of life: physical health, psychological, social relationships and environment. It also includes one facet on overall quality of life and

general health. Domain scores produced by the WHOQOL-BREF correlate highly (0·89 or above) with WHOQOL-100 domain scores (calculated on a four domain structure). The WHOQOL BREF has been demonstrated to be a valid and reliable brief assessment of QOL. Several studies showed WHOQOL-BREF questionnaire is a useful tool to measure quality of life for participants. Research using the tool previously has reported interval consistency (Cronbach's α) from 0.7 to0.85 and test-retest reliability coefficients from 0.41 to 0.79.

For example, Lee et al. (2005) used the WHOQOL-BREF Taiwan version to investigate 356 directors in primary health care centers across Taiwan. 137 study subjects completed this questionnaire. The result showed all 4 domains of QOL were positively associated with job control; while physical- and environment-related aspects of QOL were negatively associated with daily work hours and psychological demands, respectively. On the other hand, Fu et al. (2006) used the WHOQOL-Brief-Taiwan version to compare the quality of life of mid-life men and women in Australia and in Taiwan. The sample consisted of 278 Australians and 398 Taiwanese men and women. This research has addressed and contributed to the assessment of multi-cultural aspects on quality of life and has important implications for both health providers and policy makers of both countries.

Yao and Wu (2005) investigated the factorial invariance of the WHOQOL-BREF between a healthy population and populations with diseases using the data from the 2001 National Health Interview Survey (NHIS) in Taiwan. The NHIS was conducted by stratified multistage systematic sampling, resulting in responses from 13,010 participants aged 20~65. The analysis was limited to 5 diseases, where at least 200 individuals had that specific single condition; after controlling age and gender, the same perceptions on the WHOQOL-BREF questionnaire were found between disease and matched healthy groups and across disease groups.

The Carroll et al. (2000) study showed WHP-QOL-BREF is a useful alternative to the

WHOQOL-100 in evaluating quality of life improvement following major therapeutic interventions for Physical, Psychological and Environmental domains of life quality.

Lin et al. (2002) used the 28-item Taiwanese-adapted brief version of the World Health Organization's quality of life questionnaire (WHOQOL-BREF) to measure quality of life in four domains: physical capacity, psychological well-being, social relationships, and environment to examines the impact of the Chi-Chi earthquake, which hit central Taiwan on September 21, 1999, on the quality of life among the elderly survivors. 268 subjects were interviewed in a follow-up assessment 12 months after the earthquake. The results showed elderly survivors tended to report lower quality of life in terms of physical capacity, psychological well-being, and environment 12 months after the earthquake than at the assessment prior to the earthquake, regardless of the level of damage to their residences during the earthquake.

The Korean version of World Health Organization Quality of Life study assessment instrument (WHOQOL; and WHOQOL-BREF), were translated into colloquial Korean according to instructions of the WHOQOL study group. 486 subjects completed the rating. These results suggest that the Korean version of WHOQOL and WHOQOL-BREF are valid and reliable in the assessment of quality of life and that physical domain is contributing most and social and spiritual factors are contributing least to the quality of life of Koreans.

Phungrassami et al. (2004) used the WHOQOL-BREF-THAI assessment tool to measure the quality of life in cancer patients treated with radiotherapy in routine clinical practice. The result indicated the WHOQOL-BREF-THAI assessment tool was simple and easy to understand and complete. The majority of the patients (80.7%) were able to complete the questionnaire, 19 (12.6%) by themselves, 4 (2.6%) with the help of their relatives and 128 (84.8%) through the interview.

In Taiwan, Yao et al. (2000) developed the Taiwanese version of the questionnaire. The WHOQOL-Brief-Taiwan consists of 26 original items of the WHOQOL-Brief and two additional items related to Taiwanese culture. The Yao et al. (2002) study demonstrated that this questionnaire is an appropriate alternative to the long form of the WHOQOL questionnaire for use in Taiwan. Data came from 1068 subjects randomly sampled from 17 hospitals throughout Taiwan. The study results showed that interval consistency (Conbach's α) coefficient ranged from 0.7 to 0.77 from four domains: physical, psychological, social and environmental. The test-retest reliability coefficients at intervals of 2 to 4 weeks 0.41 to 0.75 at item and 0.76 to 0.80 at domain level (all $p < 0.01$), content validity coefficients were in the range of 0.53 to 0.78 for item-domain correlations, and 0.51 to 0.64 for inter-domain correlations (all $p < 0.01$).

Hwang (2003) evaluated the practicality, reliability, validity, and responsiveness of the use of the brief version of the World Health Organization Quality of Life for people aged 65 years or older. 1200 community-dwelling older people living in the Shin-Sher Township of Taichung County, Taiwan completed the brief version of World Health Organization Quality of Life at their residences either by themselves or with the assistance of an interviewer. Furthermore, score changes in each health-related quality of life domain after a fall were followed up for assessing its responsiveness. All domain scores indicated excellent discriminant validity, construct validity, and responsiveness as well as good internal consistency and intra- and inter-observer test-retest reliabilities. Nevertheless, two items related to work capacity and sexual activity had higher missing values (4.5% and 16.5%) and poor inter observer test-retest reliabilities (0.43 and 0.20). The researcher also pointed out that with a few modifications, the brief World Health Organization Quality of Life is a suitable health-related quality of life instrument for older people (Hwang 2003).

For the purposes of this study, the researcher adopted the WHOQOL-Brief-Taiwan Chinese version after receiving permission from Chang et al. (2003) (Appendix D). It contains four

domains, 26 facets, and one item for each facet: physical item (7 items), psychological health (6 items), social relationship (4 items), and environment (9 items). The other items were used to test overall perceptions of quality of life and general health. A five-point Likert scale was used in the questionnaire. The higher the score obtained means the higher the quality of life perceived by the respondent.

Medical Record

Recently, The Department of Health (DOH) in Taiwan revised the diabetes passport and booklet and emphasized the checking of blood glucose, HbA1C per 3 months or 6 months for diabetes patients. In addition, screening of diabetic complications such as ophthalmoscope examination per year was recommended. Also, in order to prevent blood and kidney disease, the new diabetes control standard added a check of a patient's micro albumin, and total cholesterol, LDL-C, HDL-C and Triglyceride, HbA1c.

(http://member.giga.net.tw/tbemwcom/06/6-5p1/tbemw6-5-2-160.htm).

After obtaining consent from the participants, the researchers reviewed the participants' medical records to obtain their diabetes-related clinical data for the past year. The clinical data included diabetes-related and non-diabetes-related co-morbidities, results from ophthalmoscope examinations, blood tests for cholesterol, triglyceride, glycosylated hemoglobin and nephropathy assessment such as urine acid, blood urea nitrogen (BUN), and serum creatinine. Results of urinary tests for micro albumin, urine protein and urine glucose were noted. Blood glucose levels were measured either by the researcher or by staff of the participating health care facilities. Blood glucose levels were assessed again after three and six months during routine medical check-up.

3.8 Pilot study

Prior to preparation of the dissertation proposal, the researcher directed a pilot study in two small communities in Taiwan, in Hsinchu and Taichung cities, during December 2005 to January, 2006. The purpose of the pilot study was to explore how diabetes researchers delivered diabetes care programmes in Taiwan, explore the factors that influence the cognition of diabetes patients' self-care and how this affects participants' quality of diabetes care and quality of life. The pilot study was also used to select variables for the proposed dissertation study and to analyse study procedures. In addition, as the validated questionnaires found in the literature were not adaptable directly to the sample of the current study, the scales were modified for use during this phase of the research. The pilot study tested the modified Summary of Diabetes Self-Care Activities (SDACA) scale and the Quality of Life (WHOQOL-Brief).

For the pilot study, a convenience sample was used. Potential participants included patients, who met two criteria: (1) 50 years or older; (2) have Type 2 diabetes mellitus. The pilot study also included nurses and volunteers working in the health care service. Professional specialists included five physicians, six head nurses, three nurses and two dietitians. Their work sites included two private clinics, four regional hospitals and six public health station in Central and Northern Taiwan. These professionals provided their views of the health care package for experimental group and questionnaires. Four individual interviews with professionals (two physicians and two dietitians) were conducted to explore their views about the quality of diabetes care in Northern Taiwan. Two patient focus groups (eight from the experimental group and seven from the control group) with a total number of 15 participants were also conducted to explore their perception about diabetes care.

Participants were asked about their characteristics such as age, education, health status and their community resources and social support such as interpersonal influences, situational factors.

Further they were asked about their disease cognition, diabetes self-care and quality of life. The participants of the pilot study were followed-up for 4 weeks. Statistical analysis using the software package SPSS for Windows, version 12, showed that the diabetes health programme had a significant effect on patients' health perceptions after four weeks follow-up (p= 0.003; experimental group pre-intervention mean 110.5 versus post-intervention mean 120.6). In contrast there were no significant changes in the control group with respect to knowledge, attitudes and behaviours. Quality of life did not change significantly in the pilot study. It was presumed that a short time period (four weeks) cannot reveal the expected change in quality of life. Within this small pilot study, the experimental group showed that the education programme was effective to change patients' knowledge, attitudes and self-care when compared to the control group. However, quality of life might need a longer follow-up time to observe change.

Patients' outcomes influencing the quality of diabetes care from the researcher's perspective were categorized into three dimensions: patient characteristics, community resources and social support, and their effect on a patient's disease cognition were investigated. The majority of Aboriginal diabetes patients from Northern Taiwan were not well-educated. Furthermore, many Aborigines had maintained their traditional food habits of consuming high-fat meat as well as smoking, drinking habits. The community environment included health resources and social support. Inconvenience, lack of communication and social support were reported as barriers for patient adherence to diet, self-monitoring of blood glucose, and insulin-injection regimens. The family was the most important social support resource in the culture of the rural area. Non-Aboriginal participants in the pilot study stated that family members were important support system for them as patients. However, families were rarely involved in patients' diabetes education. In addition, working times and places were changing because they were retired. This factor showed an impact on their financial affairs. Patients who were educated about diet control described difficulties involved in the selection of appropriate food because of

the lack of nutritional labels and the inconvenience associated with diet control.

The pilot study identified specific problems and suggestions reported by healthcare professionals and patients as important to the quality of diabetes care in Taiwan. These qualitative findings highlighted the importance of taking into account patients' demographic characteristics, community health and social support, and the structure and process of health care. These findings guided the selection of variables for this dissertation.

3.9 Sample Size

Twelve predictor variables were examined for their contribution to the outcome dependent variables. According to Knapp and Campbell-Heider (Knapp 1996; Knapp & Campbell-Heider 1989), the sample size for multiple regression analyses should be at least 10 times the number of variables. Thus, the minimal number of observations should be 120.

Group sample sizes of 98 and 98 achieve: (1) an 80% power to detect a difference of 20% between the null hypothesis, (that both group proportions are 60%) and the alternative hypothesis, (that the proportion in group 2 is 80% using a two-sided Chi-square test with continuity correction; adjusted for multiple testing). This sample size calculation refers to the first major hypothesis postulating that the proportion of patients with well-controlled blood glucose levels will rise from 60% to 80% in the intervention group compared to the control group; (2) Group sample sizes of 113 and 113 would achieve an 80% power to detect a difference of 20% between the null hypothesis (that both group proportions are 50%) and the alternative hypothesis (that the proportion in group 2 is 30% using a two-sided Chi-square test with continuity correction; adjusted for multiple testing). This second sample size calculation refers to the second major hypothesis postulating that the proportion of patients with markers for diabetic complication will decrease from 50% to 30% in the intervention group compared to the control group.

Overall, the sample size calculation suggests that a total of 440 participants (220 intervention & 220 control patients) were needed to detect the differences specified in all the hypotheses. This calculation is adjusted for multiple testing, the cluster sampling design (design effect 1.5) and an expected loss to follow up of 20%.

3.10 Data Analysis

Data were collected at baseline, and at three and six months follow-up. At each time point information from participants' medical records and self-completed questionnaires were collected. Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 14.0 and STATA for Windows, release 8.

Descriptive statistics were used to describe background variables and instrument scores. Depending on the distributions means and standard deviations (SD) or medians and inter-quartile ranges (IQR) were calculated as measures of central tendency and variation.

Standard bivariate statistical tests (Chi-square, t-test, and non-parametric Wilcoxon tests) were used to assess relationships between outcome characteristics and experimental/control status. The results of those tests were adjusted for the cluster sampling approach.

Main outcome variables: There were two main hypotheses involving two main outcome variables: (1) per cent of patients with a well-controlled blood glucose level implying to have a blood glucose level in normal range (AC: 70 to 110mg/dl or PC: 90 to 140mg/dl) and (2) per cent of patients with positive markers for diabetes complications. Markers considered were serum creatinine (normal range: 0.6 – 1.5 mg/dl), urine analysis (normal: protein and glucose both zero), microalbumin (normal: less than 30 mg), cholesterol (normal range: 130 – 225 mg/dl), triglyceride (normal range: 50 – 130 mg/dl), blood pressure (above 160 to 95 mmHg), and cataract or retinopathy present.

Multivariable logistic regression analyses (adjusted for cluster sampling) were conducted to compare (1) patients with well-controlled blood glucose levels with those that had no well-controlled level after six months of follow-up, and (2) patients with elevated markers for diabetes complications with those that had no elevated markers, allowing adjustment for potential confounding and the baseline differences between intervention and control group.

Multiple linear regression analyses were used to determine relationships between self-care activities and perceived recommendations at 6 months follow-up and the experimental/control status, adjusted for cluster sampling, confounding characteristics and baseline values.

The following self-care items were considered for multivariate analysis: (1)…followed balanced food eating, …followed eating plan, …ate high fat foods, …ate at least 5 dishes of fruit and vegetables; (2)…participated in exercise for at least 30 minutes, and …participated in specific exercise session; (3)….advice on balanced food plan, …advice on eating plan about amount of food, …advice on low fat eating, …advice on calories, …advice on fruit and vegetables, …..advice on few sweets, …advice on other related to food; (4)…advice on exercise, …advice on how much exercise, …advice on exercise as daily routine, …advice on specific exercise, …advice on other related to exercise; (5) advice on blood glucose testing, …advice on blood glucose testing at health care service, …advice on feet check, …advice on drying gaps between toes, …advice on shoes, …advice on smoking status.

A total of five multi-variate models were created: (1) self-care eating and (2) self-care exercise; (3) eating, (4) exercise, and (5) other technical aspects of recommendations received regarding self-care. Within those models, the dependent variables were created by summing up the original items (ate high fat food was reversed) and the scores were normalised using the natural logarithm (ln).

The following variables (at baseline) were considered in all multivariate analyses:

Group (intervention or control), sex, age, education, occupation, ethnicity, living alone or with partner, health insurance coverage, income, history of diabetes, diabetes complications, other chronic diseases, history of hospitalisation because of diabetes, history of participation in education program about diabetes, current treatment for diabetes, owning a diabetes patient passport, RAND social health battery, previous help by health services, previous financial help, education services in community, kind of transportation used by participant, smoking status, total score of health perception questionnaire, total score of quality of life WHO questionnaire, HbA1c and blood glucose AC. All categorical variables considered were dummy coded.

Results of multivariable logistic regression analyses were presented as relative risks, 95%-confidence intervals (95%-CI), and p-values. Results of multivariate linear regression analyses were presented with regression coefficients, 95%-confidence intervals (95%-CI), and p-values. Throughout the analysis a p-value less than 0.05 was considered statistically significant.

3.11 Ethical Consideration

Approval for this study was gained from the James Cook University Human Ethics Research Committee (H:2234) (see appendix E: Human Ethics Approval Form) (see Appendix H) and Dr.Tung, Head of JhuBei local health centre in Taiwan (see Appendix I)

All participants who took part in the study did so voluntarily. A letter introducing the researcher, which contained a Participant Information Sheet which briefly described the study and outlined the study processes, was given to potential, participants (see Participant Information Sheet in Appendix C, D). Consent to participate was signed by the participants from January to February 2006 at the beginning of the educational intervention and prior to the collection of base-line data

from March to May 2006 (see Consent Form in Appendix E, F). The Participant Information Sheet and Consent Forms informed participants that they could discontinue their involvement in the study at any time. The participants were assured they would not be identified in the resulting project reports and publications and that their information would not be shared with anyone other than members of the research team. The collected data was kept in a locked brief case while the researcher was in the field and the data entered onto a computer was password protected. All questionnaires and other data collected in the study has been stored in the School of Nursing, Midwifery and Nutrition archives section and will remain in that storage area for a minimum of 5 years after the publication of the study results. After 5 years the stored data will be destroyed, in keeping with the James Cook University data storage guidelines. Access to the original documentation is restricted to the researcher and the research supervisors.

The questionnaires used in this study were found to be tiresome for many of the older participants. As a way to assist them, the questionnaires were completed over a number of time periods and with the assistance of the researchers if required. Contact details were provided in case the participant later needed to contact the principal researcher or other members of the research team.

3.12 Summary

This chapter included a description of research design, clinical setting, participants and sampling procedure, and study protocols. The intervention method, plan for analysis of the quantitative data and medical record data, pilot study, and sample size, were also presented and described. Finally, the ethical considerations necessary for the study were described in the final section of the chapter.

The next chapter presents the study findings. It includes the characteristics of the study sites, characteristics of the sample at baseline, description of socio-demographic characteristics,

description of community resources and social support at baseline, comparisons between Aboriginal and Non-Aboriginal Taiwanese at baseline, baseline comparisons between experimental and control group, results of comparisons at 3 months of follow-up, results of comparisons at 6 months of follow-up, and finally, the results of the multivariate analysis.

CHAPTER 4: PRESENTATION OF THE FINDINGS

4.1 Introduction

This chapter describes the results of the study. The first part describes the study sample and data collection sites. In consecutive sections comparisons of intervention and control group at baseline, at 3 months and at 6 months follow-up are presented. Finally the results of the multivariate analyses of the main combined outcome measures are given.

4.2 Characteristics of the Study Sites

The study was conducted in communities of Taiwan and a total of 500 participants were recruited into the study from March 1, 2006 through to January 20, 2007. All participants were patients being seen at diabetes clinics in the participating centres in Taiwan and were identified through medical records. According to participant descriptions, the health institutions that they usually visited in 2006 included six public health centres, two private clinics, and four regional hospitals. The 12 institutions were selected for this study based on The Diabetes Medical Net of Taiwan list. The 12 institutions were formally asked to collaborate and agreed. Colleagues including four physicians, ten nurses, six staff from Hsinchu City, Bureau of Public Health, six nurses and two dieticians collaborated in the study. A total of 500 patients were recruited to the study: 241 cases to the experimental group and 259 cases to the control group. Participants were cluster randomised into either experimental group or control group. That is, participating health care institutions were differentiated as belonging either to the experimental or to the control group and diabetes patients were recruited within those institutions.

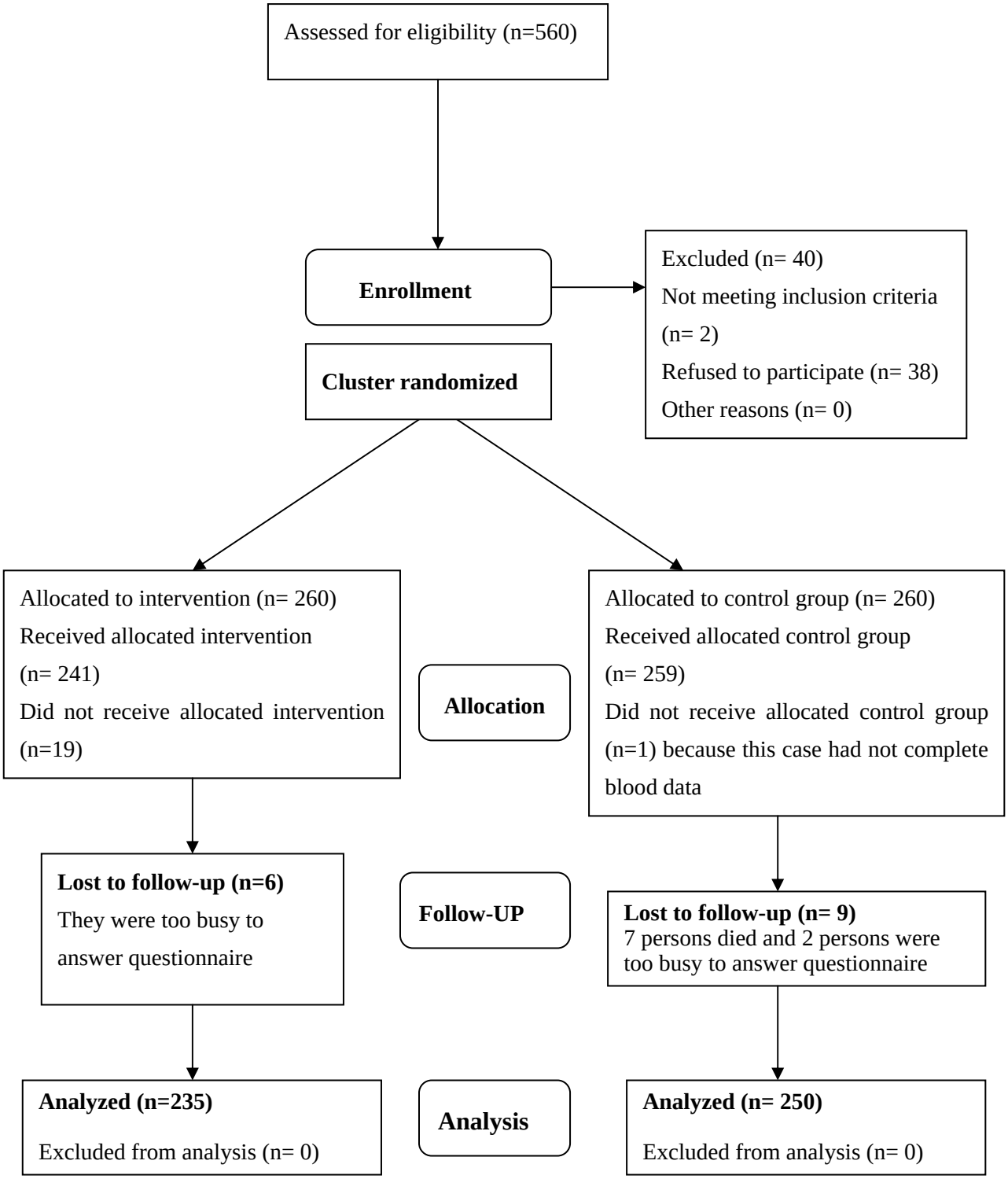
The patients in the experimental group were recruited from five public health centres, one private clinic and one regional hospital while the control group came from one public health centre, one private clinic and three regional hospitals caring for outpatients (see Table 4.1).

Following the Consort E-Flowchart (version accessed in August 2005) a total of 560 participants were assessed for eligibility. Forty cases were excluded: Two participants did not meet the inclusion criteria, and 38 cases refused to participate. Of the 520 remaining participants in this study 260 cases were allocated to the experimental group, however 19 cases did not receive the intervention because they were too busy to allow for inclusion in the three diabetic education programmes. While 260 cases were allocated to the control group, one participant was excluded from the study because of incomplete blood data.

Table 4.1: Number of participants stratified by recruiting institutions

	Experimental group	**Control group**
Six public health centres	155	42
Two private clinics	50	81
Four regional hospitals	36	136
Total	241	259

Figure 4.1: Flow chart of patients according to the CONSORT guidelines **(**Newcombe, 2000**)**



4.3 Characteristics of the sample at baseline

Characteristics of the sample include socio-demographic and diabetes-related factors. Five hundred people comprised the sample.

Description of social-demographic characteristics

A summary of participants' socio-demographic characteristics is presented in Table 4.2. The majority of participants were female (52.2%, n=261; male: 47.8%, n=239). The age range was 50-80 years: over half of the participants were 65 years of age or above (59.2%, n=296). The ethnicity of the majority of the participants was Holo (43.6%, n=218). The other participants included 25.8% (n=129) Hakkas, 16.8% (n=84) Mainlanders, and 13.8 (n=69) Aborigines. More than half of the participants (65.4%, n=327) had education levels of equal or less than six years of school education. Most participants had received elementary school education 42.4% (n=212), while 23% (n=115) had no education at all. Three hundred and seventy-three (74.6%) participants were married or in defacto relationships, 69 were widows or widowers (13.8 %), and 58 were living single, divorced, or separated. More than half of the participants (68.6%, n=343) did not work. Most of participants had no income from work and were dependent on elderly annuity from Taiwanese government (pension). About 55.2% (n=276) of the participants received NTU 6000 (elderly annuity). One hundred and fifty-seven participants were employed and 127 were working in a regular schedule and location. Most of the participants spoke Holo (Taiwanese) language (40.0%, n=200), followed by Mandarin (27.6%, n=138). Almost all of the participants (99.4%, n=497) were enrolled in the National Health Insurance Program (NHI). One hundred and thirty-one participants (26.2%) had private health insurance in addition to the NHI program. Most people rode a motorcycle (40.6%, n=203).

Table 4.2: Description of the patients' socio-demographic characteristics (n=500).

Item	Category	Frequency	%
Gender	male	239	47.8
	female	261	52.2
Age	50-54	61	12.2
	55-59	69	13.8
	60-64	72	14.4
	65-70	94	18.8
	70-74	79	15.8
	75-80	74	14.8
	>80	51	10.2
Highest level of education	No Education	115	23.0
	Elementary	212	42.4
	Junior	92	18.4
	Middle High	45	9.0
	College/university and above	36	7.2
Ethnicity	Mainlander	84	16.8
	Holo	218	43.6
	Hakka	129	25.8
	Aborigine	69	13.8
	-Amis	1	0.2
	-Atayal	61	12.2
	-Other aborigines	7	1.4
Main language	Mandarin	138	27.6
	Holo	200	40
	Hakka	113	22.6
	Aborigine	49	9.8
Marital status	Unmarried/de-facto	45	9.0
	Married/co-habited	373	74.6
	Divorced/Separated	13	2.6
	Widow/Widower	69	13.8
Work status	No/retired	343	68.6
	Yes	157	31.4
	-Regular schedule and location	127	25.4

Table 4.2 (continued): Description of the patients' socio-demographic characteristics (n=500).

Item	Category	Frequency	%
	-Irregular location	6	1.2
	-Irregular schedule	14	2.8
	-Irregular both schedule and location	56	11.2
Health insurance	Both of national health insurance and private Insurance	131	26.2
	National health insurance only	366	73.2
	None	3	.6
Diabetes duration	1-2 years	77	15.4
	2-5 years	131	26.2
	5-10 years	139	27.8
	more than 10 years	153	30.6
Diabetes prescription	diet control only	50	10.0
	oral medication only	411	82.2
	insulin injection only	24	4.8
	Combined oral and insulin injection	15	3.0
What kind of transportation do you and your family have available to you?	take a walk	80	16.0
	take a public transportation	88	17.6
	ride a bike	14	2.8
	ride a motorcycle	203	40.6
	drive a car	87	17.4
	Others	28	5.6
Average monthly income (estimate)	Less than or equal to 6000	370	74
	6001-10000	58	11.6
	10001-20000	55	11
	More than or equal to 20001	17	3.4

Description of diabetes-related characteristics

About 30.6 percent of the participants (n=153) had been informed of their diagnosis of diabetes more than 10 years ago, 27.8% knew for 5 to 10 years (n=139), 26.2 % knew for 2 to 5 years (n=131), and 15.4% knew for less than 2 years (n=77) that they had diabetes. The majority of participants (82.2%, n=411) were receiving treatment with only oral hypoglycemic medication. Twenty-four participants (4.8%) had been prescribed only insulin injections and 3.0% (n=15) were treated with both oral and injected medication. Ten percent (n=50) of participants were only under diet control.

Forty-five participants (9%) reported that they did not know whether they had diabetes complications or not and 42.4% (n=212) reported that they had no complications. Nearly half of the participants (48.6%, n=243) reported that they had experienced at least one complication resulting from their diabetes. Reported complications were cataracts, 24.2% (n=121), nephropathy, 20% (n=100), heart disease, 17.4% (n=87), retinopathy, 16.4% (n=82), foot problems, 11.4% (n=57), and kidney disease, 8.4% (n=42).

With respect to reported co-morbidity, over half of the participants (61.2%, n=306) reported that they had other chronic diseases. Co-morbidity included hypertension (52%, n=260), hyperlipidemia (17.8%, n=89), arthritis (12.8%, n=64), and others, such as hepatitis, asthma, and heart valve disease (5.2%, n=26). Seventy-eight participants (15.6%) reported that they had been hospitalized in the previous year for intensive diabetes treatment or for diabetes complications, with most participants reporting a length of stay between one to two weeks (6.2%, n=31). Over half of the participants (61.2%, n=306) reported that they also had other chronic diseases and high blood pressure was the disease most frequently reported (52.0%, n = 260).

The participants were asked to report their overall levels of blood glucose over the course of the year prior to data collection. One hundred and twelve participants (22.4%) responded that they did not know their levels. Among those who knew their levels, the average levels of pre-meal and post-meal blood glucose reported were pre-meal: median 140 (IQR = 120-175; range: 65-400); post-meal: median 190 (IQR= 158-230; range: 90-550) (see Table 4.3).

Table 4.3: Description of the patients' diabetes-related characteristics (n=500).

Item	Category	Frequency	%
Date diagnosed with diabetes	1-2 years ago	77	15.4%
	2-5 years ago	131	26.2%
	5-10 years ago	139	27.8%
	More than 10 years ago	153	30.6%
Current treatment for diabetes	Diet control only	50	10.0%
	Oral medication only	411	82.2%
	Insulin injection only	24	4.8%
	Combined oral and insulin injection	15	3.0%
Known diabetes complications	Don't know	45	9.0%
	No complication	212	42.4%
	Yes, I have	243	48.6%
	Cataract	121	24.2%
	Retinopathy	82	16.4%
	Kidney disease	42	8.4%
	Heart disease	87	17.4%
	Neuropathy (numbness of peripheral extremities)	100	20.0%

Item	Category	Frequency	%
	Foot problems	57	11.4%
In the past year, I have been hospitalized for intensive diabetes treatment or diabetes complication	No	422	84.4%
	Once	54	10.8%
	Twice	14	2.8%
	Three times and over	10	2.0%
Length of stay in hospital for first time (day) of intensive diabetes treatment	No have not stayed in hospital	437	87.4%
	Less than 7 days (total)	14	2.8%
	7 days	14	2.8%
	10 days	8	1.6%
	14 days	9	1.8%
	More than 14 days (total)	18	3.6%
Length of stay in hospital for second time (day) of intensive diabetes treatment	Had not stayed a second time in hospital	480	96%
	Less than 7 days (total)	5	1.0%
	7 days	3	0.6%
	10 days	1	0.2%
	14 days	3	0.6%
	More than 14 days (total)	8	1.6%
Length of stay in hospital for third time (day) of intensive diabetes treatment	Had not stayed a third time in hospital	491	98.2%

Item	Category	Frequency	%
	Less than 7 days (total)	1	0.2%
	7 days	1	0.2%
	More than 7 days (total)	7	1.4%
Other chronic disease apart from diabetes	None	194	38.8%
	Yes	306	61.2%
	High blood pressure	260	52.0%
	High cholesterol	89	17.8%
	Arthritis	64	12.8%
	Tuberculosis	1	0.2%
	Others	25	5.0%
In the past year, did you check average pre-meal blood glucose?	No	153	30.6%
	Yes	347	69.4%
In the past year, did you check average post-meal blood glucose?	No	211	42.2%
	Yes	289	57.8%
In the past year, did you know average blood glucose?	Yes	388	77.6%
	No	112	22.4%
In the past year, what was your average pre-meal blood glucose?	Median = 140 IQR = 120-175; range: 65-400		
In the past year, what was your average post-meal blood glucose?	Median = 190 IQR= 158-230; range: 90-550		

4.4 Description of community resources and social support at baseline

Community resources and social support included interpersonal influences and situational factors.

Description of interpersonal influences

The summary of participants' interpersonal influences including family, peers and providers supporting is presented in Table 4.4. Most of the participants lived with their families or friends (82%, n= 410). Among those included were spouses 55.4% (n=277), off-spring 58.4% (n=292), parents 2.4% (n=12), and relatives or friends 2.4% (n=12). Asked "Who is the most important person living with you?", the majority of people answered their spouse (30.6, n=153), followed by their parents (10.6%, n=53).

In addition, a median number of five families (IQR=2-10; range: 1-40) were in the participants' neighborhoods, and were well enough acquainted with the participants that they visited each other in their homes. Ten families was the answer most often given (23.2%, n=116) and most participants answered that they have such close contact to ten families or less (93.8%). Answering the question: "About how many close friends do you have - people you feel at ease with and you can talk with about what is in your mind?", three persons was the most frequently given response (20.0%, n=100) and most of participants responded that they had ten or less close friends (94.8%). When participants were asked: "Over a year's time, about how often do you get together with friends or relatives, like going out together or visiting in each other's homes?", 130 (26.0%) participants answered every day and 20.2% (n=101) answered several times per week. When asked: "During the past month, about how often have you had friends over to your home?", the majority answered several times per week (25.4%, n=127). Similarly, when asked "About how often have you visited your friends at their homes during the past month? (Do not count relatives)", the majority of participants answered several times per week (24.4%, n=122). When

asked: “About how often were you on the telephone with close friends or relatives during the past month?, about 21.4% (n=107) answered not at all, followed by several times per week (20.2%, n=101), and every day (20.0%, n=100). When asked “How often did you write a letter to a friend or relative during the past month?” most of participants answered not at all (81.4%, n=407). Over half of the participants answered that they “Get along with other people these days” about the same as before (63.6%, n=318). About 34.6% (n=173) of participants did not attend a religious service during the past month, while 26.6% of participants responded that they attended a religious service about once a week (n=133). Approximately 69.2% (n=346) of participants did not belong to any groups or organizations.

Description of situational factors

About 30.8% (n=154) and 22.4% (n=112) of participants had received hospital and health centres (stations) services to get help over the last year, respectively. About 40.4% (n=202) participants answered that they never received any help. Most of the participants talked about their health problems to service providers (40.2%, n=201), but at the same time 55.4% (n=277) had never asked service providers for help. Most of the participants received help from health consulting services or health examination services (37.4%, n=187).

Most of the participants decided to look for help when they felt that their physical condition was not good (31.8%, n=159). While they were getting help, 40.6% (n=203) had a choice and 33.4% (n=167) participants knew the people who helped them. About 23.6% (n=118) of the people who worked with the participants talked with each other about the participants’ situation. About 34.6% (n=173) of the participants reported a “somewhat” or a “great deal” of improvement of their life or life situation after they had received help. The main focus of help was to improve the participants’ health condition (36.6%, n=183), followed by their financial condition (4.6%, n=23). Apart from the main help directed towards their health, participants received other

support, most of which was financial help (31%, n=155). The main method of receiving help was directly talking to consultancy services (38.4%, n=192). Most of the elderly got financial support from the government's elderly annuity of NTU 3,000 to 6,000.

Two hundred and five participants (41%) had previously used educational services offered by their community, 59 % (n=295) had not. A total of 60.4% (n=302) of the participants responded that they had participated in a previous diabetes education programmes delivered by service providers. Many of the diabetes education programmes were individual education sessions (36.8%, n=184) less than two hours long (41.4%, n=207). However, 78% (n=390) of participants' families had not participated in any previous diabetes education.

Table 4.4: Frequency of patient characteristics information (n=500), Item 1 to 12 belongs to interpersonal influences, and item 13 to 28 belongs to situational factors.

Item	Category	Frequency	%
1. Who lives with you?	I live alone	90	18.0%
	I live with others(multiple selections)	410	82.0%
	My spouse	277	55.4%
	My offspring(s)	292	58.4%
	My parent(s)	12	2.4%
	My relative(s)	9	1.8%
	My friend(s)	3	0.6%
2. Who is the most important person living with you?	I live alone	260	52.0%
	My spouse	153	30.6%
	My off-spring(s)	31	6.2%

Table 4.4 (continued): Frequency of patient characteristics information (n=500), Item 1 to 12 belongs to interpersonal influences, and item 13 to 28 belongs to situational factors.			
Item	**Category**	**Frequency**	**%**
	My parent(s)	53	10.6%
	My relative(s)	1	0.2%
	My friend(s)	2	0.4%
3. About how many families in your neighborhood are you well enough acquainted with, that you visit each other in your homes?	1 family	68	13.6%
	2 families	79	15.8%
	3 families	62	12.4%
	4 families	30	6.0%
	5 families	72	14.4%
	6 families	21	4.2%
	7 families	9	1.8%
	8 families	12	2.4%
	10 families	116	23.2%
	More than 10 families	31	6.2%
4. About how many close friends do you have—people you fell at ease with and can talk with about what is in your mind?	1 friend	76	15.2%
	2 friends	89	17.8%
	3 friends	100	20.0%
	4 friends	19	3.8%

Table 4.4 (continued): Frequency of patient characteristics information (n=500), Item 1 to 12 belongs to interpersonal influences, and item 13 to 28 belongs to situational factors.

Item	Category	Frequency	%
	5 friends	54	10.8%
	6 friends	24	4.8%
	7 friends	7	1.4%
	8 friends	8	1.6%
	10 friends	97	19.4%
	More than 10 friends	26	5.2%
5. Over a year's time, about how often do you get together with friends or relatives, like going out together or visiting in each other's homes?	Every day	130	26.0%
	Several times a week	101	20.2%
	About once a week	83	16.6%
	2 or 3 times a month	65	13.0%
	About once a month	42	8.4%
	5 to 10 times a year	24	4.8%
	Less than 5 times a year	55	11.0%
6. During the past month, about how often have you had friends over to your home?	Every day	78	15.6%
	Several times a week	127	25.4%
	About once a week	88	17.6%
	2 or 3 times a month	79	15.8%
	Once in past month	60	12.0%
	Not at all in past month	68	13.6%

Table 4.4 (continued): Frequency of patient characteristics information (n=500), Item 1 to 12 belongs to interpersonal influences, and item 13 to 28 belongs to situational factors.

Item	Category	Frequency	%
7. About how often have you visited friends at their homes during the past month? (do not count relatives)	Every day	65	13.0%
	Several times a week	122	24.4%
	About once a week	83	16.6%
	2 or 3 times a month	71	14.2%
	Once in past month	67	13.4%
	Not at all in past month	92	18.4%
8. About how often were you on the telephone with close friends or relatives during the past month?	Every day	100	20.0%
	Several times a week	101	20.2%
	About once a week	78	15.6%
	2 or 3 times	82	16.4%
	Once	32	6.4%
	Not at all	107	21.4%
9. About how often did you write a letter to a friend or relative during the past month?	Every day	10	2.0%
	Several times a week	40	8.0%
	About once a week	17	3.4%
	2 or 3 times	16	3.2%
	Once	10	2.0%
	Not at all	407	81.4%

Table 4.4 (continued): Frequency of patient characteristics information (n=500), Item 1 to 12 belongs to interpersonal influences, and item 13 to 28 belongs to situational factors.

Item	Category	Frequency	%
10. In general, how well are you getting along with other people these days-would you say better than usual, about the same, or not as well as usual?	Better than usual	124	24.8%
	About the same	318	63.6%
	Not as well as usual	58	11.6%
11. How often have you attended a religious service during the past month?	Every day	21	4.2%
	Several times a week	33	6.6%
	About once a week	133	26.6%
	2 or 3 times	118	23.6%
	Once	22	4.4%
	Not at all	173	34.6%
12. About how many voluntary groups or organizations do you belong to-like church groups, club or lodges, parent groups, etc.	None	346	69.2%
	1 group	93	18.6%
	2 groups	27	5.4%
	3 groups	28	5.6%
	More than 3 groups	63	1.2%
13. From what place or agency have you received the main help over the last year?	Hospital	154	30.8%
	Local government	23	4.6%

Table 4.4 (continued): Frequency of patient characteristics information (n=500), Item 1 to 12 belongs to interpersonal influences, and item 13 to 28 belongs to situational factors.

Item	Category	Frequency	%
	Health station	112	22.4%
	Others	9	1.8%
	No help received	202	40.4%
14. What information about you, your family and your situation did the health service ask you when you asked or applied for help?	Talk about my health problems to consultancy service	201	40.2%
	Tell consultancy service about my financial difficulties	19	3.8%
	Others	3	0.6%
	I did not ask for help	277	55.4%
15. Of these places you told me about, what is your main receive help?	No answer	275	55.0%
	Apply disabled handbook	9	1.8%
	Apply allowance	22	4.4%
	Health consulting service or Health examination	187	37.4%
	Others	3	0.6%
	None	4	0.8%
16. How was it decided that you needed help?	No answer	305	61.0%
	I am in financial difficulties	26	5.2%
	My physical condition is not good	159	31.8%

Table 4.4 (continued): Frequency of patient characteristics information (n=500), Item 1 to 12 belongs to interpersonal influences, and item 13 to 28 belongs to situational factors.

Item	Category	Frequency	%
	Others suggesting	7	1.4%
	Other	3	0.6%
17. Did you have a choice in deciding about getting help?	No answer	279	55.8%
	Yes, I had	203	40.6%
	No, I had no choice	18	3.6%
18. Do you know the names of the people who helped you?	No answer	278	55.6%
	Yes, I know them	167	33.4%
	No, I don't know them	55	11.0%
19.Did the people who worked with you talk with each other about your situation?	No answer	280	56.0%
	Yes, they did	118	23.6%
	No, they did not	20	4.0%
	I don't know	82	16.4%
20. How did your life or situation (or both) improve as a result of the help you got?	No answer	282	56.4%
	Not at all	6	1.2%
	A little	39	7.8%
	Somewhat	97	19.4%
	A great deal	76	15.2%
21. Of the help you got, what helped it most in your life?	No answer	284	56.8%
	My financial condition	23	4.6%

Table 4.4 (continued): Frequency of patient characteristics information (n=500), Item 1 to 12 belongs to interpersonal influences, and item 13 to 28 belongs to situational factors.			
Item	**Category**	**Frequency**	**%**
	My health condition	183	36.6%
	My interpersonal relation	5	1.0%
	Others	5	1.0%
22. Of the help you got, have others yes with you in your life yes with (multiple selections)?	Financial problem	155	31.0%
	Health problem	27	5.4%
	Interpersonal relation	89	17.8%
	Others	15	3.0%
	None	12	2.4%
23. If you could change anything about the way you get help when you need it, what would it be?	No answer	279	55.8%
	Directly tell consultancy service	192	38.4%
	Call a phone to consultancy service	2	.4.0%
	Write a letter or e-mail to consultancy service	22	4.4%
	Other methods	5	1.0%
24. Did you receive any financial support?	Yes, I did	327	65.4%
	No, I did not	173	34.6%
25. Did you have any education services in your community?	Yes, I did	205	41.0%
	No, I did not	295	59.0%

Table 4.4 (continued): Frequency of patient characteristics information (n=500), Item 1 to 12 belongs to interpersonal influences, and item 13 to 28 belongs to situational factors.

Item	Category	Frequency	%
26. Have you previously participated in a diabetes education program (multiple choices)?	No	198	39.6%
	Yes	302	60.4%
	Individual education	184	36.8%
	Group education with discussion	38	7.6%
	Lecture diabetes –education	52	10.4%
27. How many hours did you have diabetes education over the past year?	None	119	23.8%
	Less than 2 hours	207	41.4%
	3 to 4 hours	72	14.4%
	4 to 6 hours	41	8.2%
	6 to 8 hours	36	7.2%
	More than 8 hours	25	5.0
28. Has your family participated in the diabetes education?	Yes	110	22.0%
	No	390	78.0%

4.5 Comparisons between Aboriginal (=Amis, Atayal, and others) and Non-Aboriginal Taiwanese at baseline

This section presents the results of statistical comparisons of Aboriginal and Non-Aboriginal Taiwanese. The two groups were compared with respect to socio-demographic characteristics and self-care activities.

Comparisons of demographic characteristics between Aboriginal (n=69) and Non-aboriginal (n=431) participants at baseline are presented in Table 4.5. The majority of demographic characteristics Aboriginal and Non-aboriginal participants were not significantly different at baseline ($p > 0.05$). However, there were 69.7% Aboriginal participants with known diabetes complications compared to 50.6% Non-aboriginal participants ($p = 0.003$) and 89.9% Aborigine with other chronic diseases compared to 56.8% Non-aboriginal participants with other chronic diseases ($p < 0.001$).

Comparisons of socio-demographic characteristics (RAND social health battery) between Aboriginal (n=69) and Non-aboriginal (n=431) participants at baseline are presented in Table 4.6. All presented values were adjusted for cluster sampling. There were few significant differences between Aboriginal and Non-aboriginal participants. Asking participants “Who had friends over at home daily during past month?”, 16.7% Non-aboriginal participants compared to 8.7% Aboriginal participants answered yes ($p = 0.040$). Asking participants “Whether they get better along with other people these days?”, 28.5% of Non-aboriginal participants compared to 1.4% Aboriginal participants answered yes ($p = 0.002$). When asked “Whether they had attended a religious service during past month”? 36.4% of Non-aboriginal participants compared to 23.2% Aboriginal participants answered no ($p = 0.024$). When asked “Whether they had belonged to any voluntary groups”? 71.7% of Non-aboriginal participants compared to 53.6% Aboriginal participants answered no ($p = 0.009$).

Comparisons of results of self-care activities between Aboriginal (n=69) and Non-aboriginal (n=431) at baseline are presented in Table 4.7. This part asked participants to remember their self-care activities during the previous week. There were no statistically significant differences between Aborigines and Non-Aborigines except when asked “How often during the last week they were eating at least 5 dishes of fruit and vegetables?” with Non-aboriginal participants being more likely to eat more fruit and vegetables ($p = 0.048$).

Comparison of results of the Health Perception Questionnaire between Aboriginal and Non-aboriginal participants at baseline is presented in Table 4.8. All presented values were adjusted for cluster sampling. From Table 4.8 we can see that the mean of total scale showed a significant difference between Aboriginal (mean = 105.5, SD 10.5) and Non-aboriginal (mean = 111.2, SD 9.4) participants ($p = 0.002$).

Table 4.5: Comparison of demographic characteristics between Aboriginal (n=69) and Non-aboriginal (n=431) participants at baseline. All presented values were adjusted for cluster sampling.

	Non-Aboriginal (n=431)	**Aboriginal (N=69)**	**p-value**	**Adjusted p-value***
% Male	47.1%	52.2%	p=0.440	p=0.380
% Age 70+ years	43.2%	26.0%	p=0.007	p=0.093
% With no school education	23.4%	20.3%	p=0.311	p=0.527
% With no current occupation	71.5%	50.7%	p=0.001	p=0.059
% Married	74.5%	75.4%	p=0.096	p=0.148
% Living alone	18.8%	13.0%	p=0.248	p=0.594
% With National health insurance only	71.5%	84.1%	p=0.100	p=0.323
Median monthly income [IQR]**	6,000 [6000, 15000]	10000 [6000, 18000]	p=0.009	p=0.244
% Who have car available for transport	15.5%	29.0%	p=0.004	p=0.413
% Diagnosed with diabetes more than 10 years ago	29.9%	34.8%	p=0.022	p=0.132
% With known diabetes complications	50.6%	69.7%	p=0.005	p=0.003
% With other chronic disease	56.8%	89.9%	p<0.001	p<0.001
% Not hospitalised for intensive diabetes treatment during last year	84.5%	84.1%	p=0.366	p=0.588
Mean pre-meal blood glucose during last year (SD)***	152.4 (49.9)	154.6 (74.6)	p=0.601	p=0.865

Table 4.5 (continued): Comparison of demographic characteristics between Aboriginal (n=69) and Non-aboriginal (n=431) participants at baseline. All presented values were adjusted for cluster sampling.

	Non-Aboriginal (n=431)	**Aboriginal (N=69)**	**p-value**	**Adjusted p-value***
Mean recent pre-meal blood glucose (SD)	162.3 (57.5)	166.5 (64.6)	p=0.699	p=0.907
% Who participated in diabetes education	60.3%	60.9%	p=1	p=0.962
% Who receive oral medication only as current treatment	81.7%	85.5%	p=0.138	p=0.683
% With diabetes patient passport	52.0%	47.8%	p=0.595	p=0.786

*adjusted for cluster sampling strategy; **IQR = inter-quartile range; ***SD = standard deviation.

Table 4.6: Comparison of socio-demographic characteristics (RAND social health battery) between Aboriginal (n=69) and Non-aboriginal (n=431) participants at baseline. All presented values were adjusted for cluster sampling.

	Non-Aboriginal (n=431)	**Aboriginal (N=69)**	**p-value**	**Adjusted p-value***
Median number of families that visit [IQR]	4 [2, 10]	5 [5, 10]	p<0.001	p=0.219
Median number of close friends [IQR]	3 [2, 10]	3 [3, 5]	p=0.197	p=0.862
% Who got together with friends or relatives daily during past year	23.9%	39.1%	p=0.007	p=0.225
% Who had friends over at home daily during past month (several times a week)	16.7% (21.3%)	8.7% (50.7%)	p<0.001	p=0.040

Table 4.6 (continued): Comparison of socio-demographic characteristics (RAND social health battery) between Aboriginal (n=69) and Non-aboriginal (n=431) participants at baseline. All presented values were adjusted for cluster sampling.

	Non-Aboriginal (n=431)	**Aboriginal (N=69)**	**p-value**	**Adjusted p-value***
% Who visited friends daily during past month (several times a week)	13.7% (20.9%)	8.7% (46.4%)	p<0.001	p=0.097
% Who phoned close friends or relatives daily during past month	17.4%	36.2%	p<0.001	p=0.198
% Who did not write any letter to a friend or relative during past month	84.2%	63.8%	p<0.001	p=0.102
% Who get better along with other people these days	28.5%	1.4%	p<0.001	p=0.002
% Who did not attend a religious service during past month	36.4%	23.2%	p<0.001	p=0.024
% Who do not belong to any voluntary groups	71.7%	53.6%	p<0.001	p=0.009
% Who did not receive any help by social services during last year	38.2%	44.1%	p<0.001	p=0.214
% Who received financial support	66.6%	58.0%	p=0.174	p=0.374
% Who had educational services in community	38.5%	56.5%	p=0.006	p=0.399

*adjusted for cluster sampling strategy; **IQR = inter-quartilerange; ***SD = standard deviation.

Table 4.7: Comparison of results of self-care activities between Aboriginal (n=69) and Non-aboriginal (n=431) participants at baseline. All presented values were adjusted for cluster sampling.

Median number of days during last week [IQR]…	**Non-Aboriginal (n=431)**	**Aboriginal (n=69)**	**p-value**	**Adjusted p-value***
followed balanced food eating	4 [2, 7	4 [3, 4]	p=0.324	p=0.434
followed eating plan	3 [1, 5]	4 [3, 4]	p=0.808	p=0.689
ate high fat foods	3 [0, 4]	0 [0, 4]	p=0.002	p=0.402
ate at least 5 dishes of fruit and vegetables	4 [2, 7]	3 [0, 4]	p<0.001	p=0.048
participated in exercise for at least 30 minutes	4 [1, 7]	2 [0, 4]	p<0.001	p=0.191
participated in specific exercise session	2 [0, 5]	2 [0, 3]	p=0.272	p=0.169
tested blood glucose	1 [0, 1]	0 [0, 3]	p=0.344	p=0.637
tested blood glucose according to doctor's guideline	0 [0, 1]	0 [0, 2]	p=0.138	p=0.532
checked feet	3 [0, 7]	2 [2, 7]	p=0.106	p=0.747
inspected inside of shoes	1 [0, 6]	2 [0, 3]	p=0.264	p=0.993
washed feet	7 [7, 7]	7 [7, 7]	p=0.514	p=0.524
dried gaps between toes	7 [1, 7]	3 [2, 7]	p=0.303	p=0.732
smoked a cigarette	0 [0, 0]; range 0 – 5 days	0[0,0]; range 0 – 6 days	p=0.004	p=0.061

*adjusted for cluster sampling strategy; **SD = standard deviation.

Table 4.8: Comparison of results of Health Perception Questionnaire between Aboriginal (n=69) and Non-aboriginal (n=431) participants at baseline. All presented values were adjusted for cluster sampling.

	Non-Aboriginal (n=431)	Aboriginal (n=69)	p-value	Adjusted p-value*
Mean of total scale (SD)**	111.2 (9.4)	105.5 (10.5)	p < 0.001	p = 0.002
Mean of "current health" subscale (SD)	28.2 (3.6)	26.4 (3.0)	p < 0.001	p < 0.001
Mean of "prior health" subscale (SD)	8.9 (1.9)	8.0 (2.2)	p < 0.001	p = 0.206
Mean of "health outlook" subscale (SD)	15.0 (2.2)	13.4 (2.1)	p < 0.001	p = 0.002
Mean of "resistance to illness" subscale (SD)	12.1 (2.0)	11.2 (1.4)	p < 0.001	p = 0.048
Mean of "health worry" subscale (SD)	18.2 (3.1)	18.6 (2.4)	p = 0.249	p = 0.363
Mean of "sickness orientation" subscale (SD)	4.1 (0.8)	3.8 (0.7)	p = 0.015	p = 0.011

*adjusted for cluster sampling strategy; **SD = standard deviation.

4.6 Baseline comparisons between experimental and control group

This section presents the comparisons of experimental and control group at baseline. The two groups were compared with respect to socio-demographic and clinical characteristics, results of the Health Perception Questionnaire and the results of the WHO quality of life questionnaire (Taiwan version). The study had two main hypotheses: (1) reducing the percentage of participants with blood glucose level above normal range through intervention, and (2) reduction of markers of complications through intervention.It was noticed that baseline differencves existed and as a result, multivariate analyses were necessary. Results of multivariate analyses comparing intervention and control groups at 6 months, adjusted for

baseline differences, were both statistically significant. The before-after comparisons for HbA1c and AC were significant for the intervention group ($p<0.001$, respectively); for the control group the HbA1c comparison was not significant ($p=0.072$), but the AC ($p=0.028$) was. Before-after comparisons for PC were not significant for both intervention and control group, potentially caused by the marked baseline and 6 months measurement for PC.

Firstly, comparison of demographic characteristics between experimental (n=241) and control group (n=259) at baseline are presented. All presented values were adjusted for the cluster sampling approach. The participants' demographic characteristics and results of comparisons are presented in Table 4.9. For the majority of the demographic characteristics, the experimental and control group were not statistically different at baseline ($p >0.05$). Exceptions were: 83% of the experimental group compared to 66.8% of the control group were married ($p = 0.030$); the average pre-meal blood glucose in the experimental group was 136.5 compared to 162.1 in the control group ($p = 0.019$); and recent pre-meal blood glucose in the experimental group was 135.1 compared to 164.5 in the control group ($p = 0.001$). More than half of the experimental group (71.4%) had a diabetes patient passport compared to 32.8% of the control group ($p = 0.007$).

Secondly, comparisons of socio-demographic characteristics (RAND social health battery) between experimental (n=241) and control group (n=259) at baseline are presented in Table 4.10. There were few significant differences between experimental and control group.

When asked "About how often did you write a letter to a friend or relative during the past month?", there were 71.8% of the experimental group versus 90.4% of the control group who answered that they had not written any letters to a friend or relative during past month (p 0.003);

When asked "How active are you in the affairs of these groups or clubs you belong to?" most participants answered that they did not belong to any voluntary groups: 56.4% of the

experimental group versus 81.1% of the control group ($p = 0.005$); When asked “From which places or agencies have you received help over the last year?”, 35.4% of the experimental group and 42.5% of the control group answered that they had not received any help by social services during the last year ($p = 0.018$).

Table 4.9: Comparison of demographic characteristics between experimental (n=241) and control group (n=259) at baseline. All presented values were adjusted for cluster sampling.

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
Gender	Male	48.6%	47.1%	p=0.747	p=0.836
Age	more than 70 years	43.6%	38.2%	p<0.001	p=0.175
Highest level of education	with no school education	20.3%	25.5%	p=0.049	p=0.534
Ethnicity	Holo	46.1%	41.3%	p=0.310	p=0.902
Main language	Holo	41.5%	38.6%	p=0.031	p=0.836
Marital status	Married	83.0%	66.8%	p<0.001	p=0.030
Work status	No/retired	69.3%	68.0%	p=0.747	p=0.556
Health insurance	National Health Insurance only	73.0%	73.4%	p=0.969	p=0.893
Diabetes duration	more than 10 years	29.1%	32.1%	p=0.908	p=0.949
Known diabetes complication	With known diabetes complications	42.3%	54.4%	p=0.026	p=0.326
Have any other chronic disease apart from diabetes	With other chronic disease	66.0%	57.1%	p=0.026	p=0.366

Table 4.9 (continued): Comparison of demographic characteristics between experimental (n=241) and control group (n=259) at baseline. All presented values were adjusted for cluster sampling.

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
In the past year, have been hositalized for intensive diabetes treatment or diabetes complications	Not hospitalised for intensive diabetes treatment during last year	85.9%	83.0%	p=0.631	p=0.643
Average pre-meal blood glucose in the past year	Mean pre-meal blood glucose during last year (SD)***	136.5 (41.5)	162.1 (47.8)	p<0.001	p=0.019
Recent pre-meal blood glucose	Mean recent pre-meal blood glucose (SD)	135.1 (35.0)	164.5 (58.4)	p<0.001	p=0.001
participated in a diabetes education program (multiple choices)	Participated in diabetes education	55.2%	65.3%	p=0.014	p=0.164
Diabetes prescription	Oral medication only as current treatment	88.8%	76.1%	p=0.001	p=0.090
Diabetes patient passport	With diabetes patient passport	71.4%	32.8%	p<0.001	p=0.007
What kind of transportation do you and your family have available to you?	Who have car available for transport	13.3%	21.2%	p<0.001	p=0.095

Table 4.9 (continued): Comparison of demographic characteristics between experimental (n=241) and control group (n=259) at baseline. All presented values were adjusted for cluster sampling.

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
Average monthly income (estimate)	Median monthly income [IQR]**	6000 [6000, 18000]	6000 [6000, 15000]	p=0.704	p=0.681
Who lives with you?	Living alone	6.6%	28.6%	p<0.001	p=0.056

*adjusted for cluster sampling strategy; **IQR= inter-quartile range; ***SD = standard deviation.

Table 4.10: Comparison of socio-demographic characteristics (RAND social health battery) between experimental (n=241) and control group (n=259) at baseline.

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
About how many families in your neighborhood are you well enough acquainted with, that you visit each other in your homes?	Median number of families that visit [IQR]	5 [3, 10]	3 [2, 10]	p=0.001	p=0.371
About how many close friends do you have — people you fell at ease with and can talk with about what is your mind?	Median number of close friends [IQR]	4 [3, 10]	3 [2, 6]	p<0.001	p=0.200
Over a year's time, about how often do you get together with friends or relatives, like going out together or visiting in each other's homes?	Who got together with friends or relatives daily during past year	30.7%	21.6%	p=0.114	p=0.498

Table 4.10 (continued): Comparison of socio-demographic characteristics (RAND social health battery) between experimental (n=241) and control group (n=259) at baseline**.**

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
During the past month, about how often have you had friends over to your home?	Who had friends over at home daily during past month	14.9%	16.2%	p=0.058	p=0.536
About how often have you visited with friends at their homes during the past month?	Who visited friends daily during past month	10.8%	15.1%	p=0.028	p=0.524
About how often were you on the telephone with close friends or relatives during the past month?	Who phoned close friends or relatives daily during past month	24.1%	16.2%	p<0.001	p=0.070

Table 4.10 (continued): Comparison of socio-demographic characteristics (RAND social health battery) between experimental (n=241) and control group (n=259) at baseline**.**

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
About how often did you write a letter to a friend or relative during the past month?	Who did not write any letter to a friend or relative during past month	71.8%	90.4%	p<0.001	p=0.003
In general, how well are you getting along with other people these days -would you say better than usual, about the same, or not as well as usual?	Who get better along with other people these days	27.8%	22.0%	p=0.006	p=0.432
How often have you attended a religious service during the past month?	Who did not attend a religious service during past month	34.0%	35.1%	p=0.003	p=0.505

Table 4.10 (continued): Comparison of socio-demographic characteristics (RAND social health battery) between experimental (n=241) and control group (n=259) at baseline**.**

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
How active are you in the affairs of these groups or clubs you belong to?	Who do not belong to any voluntary groups	56.4%	81.1%	p<0.001	p=0.005
From what places or agencies have you received help over the last year?	Who did not receive any help by social services during last year	35.4%	42.5%	p<0.001	p=0.018
Did you have any financial support?	Who received financial support	65.6%	65.3%	p=1	p=0.983
Did you have any education services in your community?	Who have educational services in community	44.0%	38.2%	p=0.203	p=0.753

*adjusted for cluster sampling strategy; **IQR = inter-quartile range; ***SD = standard deviation.

In addition, comparisons of clinical characteristics between experimental (n=241) and control group (n=259) at baseline were conducted. From Table 4.11, we can see that most clinical characteristics were not statistically significantly different at baseline ($p > 0.05$).

Mean blood glucose was significantly lower in the experimental group compared to the control group ($p = 0.048$); and 92.4% in the experimental group compared to 77.9% of the control group showed a normal ophthalmoscopic assessment ($p = 0.021$).

Table 4.11: Comparison of clinical characteristics between experimental (n=241) and control group (n=259) at baseline.

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
Medical Record: HbA1C	Mean HbA1C (SD)**; missing 0	6.6 (1.6)	7.2 (1.7)	p<0.001	p=0.165
Medical Record: Blood glucose, AC	Mean Blood glucose, AC (SD); missing 5	147.4 (50.3)	167.3 (56.1)	p<0.001	p=0.048
Medical Record: Blood glucose, PC	Mean Blood glucose, PC (SD); missing 312	208.7 (76.3)	208.4 (76.9)	p=0.979	p=0.960
Medical Record:nephropathy assessment: BUN	Median nephropathy assessment :BUN[IQR]***; missing 484	NA (0 cases)	22.5 [15.3, 40.3] 16 cases	/	/
Medical Record: nephropathy assessment: serum creatinine	Median serum creatinine [IQR]; missing 39	0.9 [0.7, 1.1]	1.0 [0.8, 1.3]	p<0.001	p=0.136
Medical Record: nephropathy assessment: urine acid	Mean urine acid (SD); missing 471	6.0 (1.6)	4.9 (1.8)	p=0.154	p=0.046

Table 4.11 (continued): Comparison of clinical characteristics between experimental (n=241) and control group (n=259) at baseline.

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
Medical Record: nephropathy assessment: urine protein	Urine protein equal 0; missing 117	100%	80.7%	p<0.001	p=0.246
Medical Record: nephropathy assessment: urine glucose	Urine glucose equal 0; missing 110	100%	95.4%	p=0.004	p=0.300
Medical Record: nephropathy assessment: micro albumin	Median micro albumin [IQR]; missing 56	0 [0, 0]	0 [0, 1.5]	p<0.001	p=0.030
Medical Record: lipid profile: cholesterol	Mean cholesterol (SD); missing 42	190.4 (36.2)	194.8 (46.1)	p=0.254	p=0.570
Medical Record: lipid profile: LDL-C	Mean LDL-C (SD); missing 308	129.6 (33.5)	124.1 (34.9)	p=0.322	p=0.567
Medical Record: lipid profile: HDL-C	Mean HDL-C (SD); missing 291	45.3 (16.1)	50.1 (17.1)	p=0.063	p=0.466

Table 4.11 (continued): Comparison of clinical characteristics between experimental (n=241) and control group (n=259) at baseline.

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
Medical Record: lipid profile:triglyceride	Median triglyceride [IQR]; missing 45	103 [84, 159]	152.5 [107.8, 193]	p<0.001	p=0.070
Medical Record: systolic blood pressure	Mean systolic blood pressure (SD); missing 0	131.0 (15.1)	135.4 (13.7)	p=0.001	p=0.195
Medical Record: diastolic blood pressure	Mean diastolic blood pressure (SD); missing 0	80.6 (8.5)	80.9 (9.7)	p=0.781	p=0.924
Medical Record: Ophthalmoscopic assessment	Ophthalmoscope assessment normal; missing 5	92.4%	77.9%	p<0.001	p=0.021
Medical Record: body weight	Mean body weight (SD); missing 0	62.7 (11.0)	64.7 (10.0)	p=0.035	p=0.306

*adjusted for cluster sampling strategy; **SD = standard deviation; ***IQR = inter-quartile range.

Comparisons of results from the Health Perception Questionnaire and from the WHO quality of life questionnaire (Taiwan version) between experimental (n=241) and control group (n=259) at baseline showed no significant differences at baseline (Tables 4.12 and 4.13). Cronbach's alpha (33 items) for total Health Perception Questionnaire is 0.623 and Cronbach's alpha (index of validity; 28 items) for the WHO quality of life questionnaire (Taiwan version) is 0.891.

Table 4.12: Comparison of results of Health Perception Questionnaire between experimental (n=241) and control group (n=259) at baseline.

	Experimental group (n=241)	**Control group (n=259)**	**p-value**	**Adjusted p-value***
Mean of total scale(SD)**	110.5 (9.4)	110.3 (10.0)	p=0.853	p=0.944
Mean of "current health" subscale (SD)	28.4 (3.6)	27.6 (3.6)	p=0.011	p=0.352
Mean of "prior health" subscale (SD)	8.9 (1.8)	8.6 (2.0)	p=0.137	p=0.503
Mean of "health outlook" subscale (SD)	14.9 (2.1)	14.8 (2.3)	p=0.608	p=0.845
Mean of "resistance to illness" subscale (SD)	12.1 (2.0)	11.9 (2.0)	p=0.145	p=0.615
Mean of "health worry" subscale (SD)	18.2 (2.8)	18.3 (3.2)	p=0.554	p=0.756
Mean of "sickness orientation" subscale (SD)	3.9 (0.8)	4.1 (0.7)	p=0.003	p=0.146

*adjusted for cluster sampling strategy; **SD = standard deviation.

Table 4.13: Comparison of results of WHO quality of life questionnaire (Taiwan version) between experimental (n=241) and control group (n=259) at baseline.

	Experimental group (n=241)	**Control group (N=259)**	**p-value**	**Adjusted p-value***
Mean of total score (SD)**	88.9 (11.5)	89.6 (13.1)	p=0.572	p=0.861
Mean of health related quality of life (SD)	67.3 (12.3)	61.9 (17.4)	p<0.001	p=0.260
Mean of quality of life before diagnosis with diabetes (SD)	73.4 (10.9)	73.7 (16.4)	p=0.794	p=0.945

*adjusted for cluster sampling strategy; **SD = standard deviation.

Comparisons of results of self-care activities between experimental (n=241) and control group (n=259) at baseline are presented in Table 4.14. This part asked participants to remember their self-care activities during the previous week. There were three statistically significant differences between experimental and control group.

Participants in the experimental group had a median number of 3 days per week in which they participated in specific exercise session compared to a median number of 1 day per week for the control group (p = 0.047). Participants in the experimental group had a median number of 2 days per week in which they checked their feet compared to a median number of 5 days per week for the control group (p <0.001). Participants in the experimental group had a median number of 1 day per week in which they inspected the inside of their shoes compared to a median number of 2 days per week for the control group (p = 0.045).

Table 4.14: Comparison of results of self-care activities between experimental (n=241) and control group (n=259) at baseline.

Median number of days during last week [IQR]…	Experimental group (n=241)	Control group (N=25)	p-value	Adjusted p-value*
…followed balanced food eating	4 [2, 6]	4 [2, 7]	p=0.497	p=0.871
…followed eating plan	4 [1, 5]	3 [1, 6]	p=0.949	p=0.824
…ate high fat foods	3 [0, 4]	3 [0, 4]	p=0.090	p=0.547
…ate at least 5 dishes of fruit and vegetables	4 [0, 7]	4 [2, 5]	p=0.155	p=0.736
…participated in exercise for at least 30 minutes	4 [2, 7]	3 [0, 6]	p=0.001	p=0.205
…participated in specific exercise session	3 [1, 5]	1 [0, 4]	p<0.001	p=0.047
….tested blood glucose	1 [0, 3]	1 [0, 1]	p=0.795	p=0.725
…tested blood glucose according to doctor's guideline	0 [0, 2]	0 [0, 1]	p=0.433	p=0.455
….checked feet	2 [0, 3]	5 [0, 7]	p<0.001	p<0.001
…inspected inside of shoes	1 [0, 3]	2 [0, 7]	p=0.001	p=0.045
…washed feet	7 [7, 7]	7 [7, 7]	p=0.465	p=0.855
…dried gaps between toes	4 [1, 7]	7 [2, 7]	p=0.022	p=0.229
…smoked a cigarette	0 [0,0]	0 [0, 0]	p=0.291	p=0.256

*adjusted for cluster sampling strategy; **SD = standard deviation.

Comparison of results of self-care recommendations between experimental (n=241) and control group (n=259) at baseline are presented in Table 4.15. This part asked participants to remember the self-care recommendations given by their health care service places. There were two statistically significant differences between the two groups. 33.2% of participants in the experimental group compared to 63.7% in the control group said that their health care team recommended eating few sweets (p = 0.013). 18.7% of participants in the experimental group

compared to 3.5% in the control group said that they had not received any advice on diet (p = 0.001).

Comparison of results of self-care activities with respect to medication showed no significant differences between experimental (n=241) and control group (n=259) at baseline (Table 4.16).

Table 4.15: Comparison of results of self-care recommendations between experimental (n=241) and control group (n=259) at baseline.

Who had been recommended by health care team to (a)….	**Experimental group (n=241)**	**Control group (N=259)**	**p-value**	**Adjusted p-value***
…balanced foot plan	75.1%	79.9%	p=0.200	p=0.466
…food eating	39.0%	41.3%	p=0.648	p=0.860
…low-fat eating plan	55.2%	56.4%	p=0.857	p=0.923
…reduce calories	29.1%	41.7%	p=0.004	p=0.117
…eat fruit and vegetables	34.9%	50.4%	p=0.001	p=0.231
…eat few sweets	33.2%	63.7%	p<0.001	p=0.013
No advice given about diet	18.7%	3.5%	p<0.001	p=0.001
….exercise frequently	68.1%	74.9%	p=0.093	p=0.256
…exercise with time advice	52.7%	63.3%	p=0.018	p=0.336
…exercise in daily routine	31.1%	27.8%	p=0.433	P=0.812
…exercise exactly specified	8.7%	17.4%	p=0.005	p=0.123
No advice given about exercise	21.2%	9.3%	p<0.001	p=0.094
…Test blood glucose with machine	32.0%	39.8%	p=0.077	p=0.579

Who had been recommended by health care team to (a)….	**Experimental group (n=241)**	**Control group (N=259)**	**p-value**	**Adjusted p-value***
…Test blood glucose at health care service	58.9%	63.7%	p=0.312	p=0.723
No advice about testing blood glucose	20.8%	9.3%	p<0.001	p=0.055
….check feet daily	56.0%	72.6%	p<0.001	p=0.103
…dry gaps between toes	58.5%	57.1%	p=0.786	p=0.907
…shoes for diabetes patients	45.6%	55.2%	p=0.039	p=0.309
No advice about foot care	28.6%	15.4%	p<0.001	p=0.064
Asked about smoking status	51.0%	51.0%	P=1	P=0.983
Smokers given advice on how to withdraw	14.4%	18.3%	P=0.525	P=0.682
Current smokers	6.2%	13.1%	P=0.003	P=0.149

*adjusted for cluster sampling strategy; **SD = standard deviation.

Table 4.16: Comparison of results of self-care activities with respect to medication between experimental (n=241) and control group (n=259) at baseline.

	Experimental group (n=241)	**Control group (N=259)**	**p-value**	**Adjusted p-value***
Doctor prescribed….				
…Insulin injection only	6.6%	12.4%	p=0.034	p=0.297
…Oral medication only	93.0%	90.0%	p=0.266	p=0.577
…Both insulin and oral medication	4.2%	5.8%	p=0.420	p=0.468
…neither insulin nor oral medication was prescribed	3.3%	2.7%	p=0.795	p=0.633
with insulin shot 3 or more times per day	1.2%	0.4%	p=0.013	p=0.270
with oral medication 3 or more times per day	9.5%	7.7%	p=0.655	p=0.930
Median number of days during last week [IQR]… (of people who take those medications)				
…took recommended oral medication	7 [7, 7]	7 [7, 7]	p=0.402	p=0.689
…took oral medication on time	7 [7, 7]	7 [7, 7]	p=0.765	p=0.695
…took recommended insulin injection	7 [7, 7]	7 [7, 7]	p=0.979	p=0.153

Table 4.16 (continued): Comparison of results of self-care activities with respect to medication between experimental (n=241) and control group (n=259) at baseline.				
	Experimental group (n=241)	**Control group (N=259)**	**p-value**	**Adjusted p-value***
Doctor prescribed….				
…took recommended insulin injection on time	7 [7, 7]	7 [7, 7]	p=0.810	p=0.176

*adjusted for cluster sampling strategy; **SD = standard deviation.

4.7 Results of comparisons at 3 months of follow-up

Outcome variables in this study include clinical characteristics, results of the Health Perception Questionnaire, result of self-care activities, results of self-care recommendation and results of the WHO quality of life questionnaire (Taiwan version). Experimental and control group outcome variables after 3 months of follow-up were compared and are described in this section.

After 3 months of follow-up, many clinical characteristics showed statistically significant differences between experimental (n=241) and control group (n=259) ($p < 0.05$). For example, the mean HbA1c was significantly lower in the experimental compared to the control group ($p = 0.023$). Other significant items included mean blood glucose AC ($p = 0.002$), mean blood glucose PC ($p = 0.034$), mean systolic blood pressure ($P = 0.037$), and the ophthalmoscopic assessment ($p = 0.022$) (Table 4.17).

Comparisons between experimental (n=241) and control group (n=259) at 3 months of follow-up with respect to the Health Perception Questionnaire and the WHO quality of life questionnaire (Taiwan version) showed no statistically significant differences (Table 4.18 and

Table 4.19).

Comparisons between experimental (n=241) and control group (n=259) at 3 months of follow-up with respect to the self-care activities are presented in Table 4.20. The self-care activities scale is asking participants to remember their self-care activities from the previous week. Data analysis showed some significant differences between the experimental and the intervention group. On average participants in the experimental group spent more days of the week exercising at least 30 minutes per day and participating in specific exercise session when compared with the control group (p = 0.035, p = 0.021, respectively). Participants in the experimental group had on average spent more days of the past week testing their blood glucose (p=0.025) and also testing their blood glucose according to doctor's guidelines (p = 0.005) when compared to control group. In addition, participants in the experimental group dried the gaps between their toes every day of the last week while the control participants had done this only a median number of 6 days (p = 0.018).

Comparisons between experimental (n=241) and control group (n=259) at 3 months of follow-up with respect to self-care recommendations given by health care services were presented in Table 4.21. The following items showed statistical significance: (1) in eating habits: all participants (100%) of experimental group said that they receiving recommendation about eating plan with amount of foods compared with 50.4% of the control group from health professionals (p = 0.001); 100% of the experimental group versus 55.2% of the control group said that they receiving recommendation about low-fat eating plan from health professionals (p = 0.008); 100% of the experimental group compared to 47.2% of the control group said that they receiving recommendation about reduced their calorie intake from health professionals (p = 0.004). 100% of the experimental group compared to 46.0% in control group said that they receiving recommendations about the importance of eating fruit and vegetables from health professionals (p = 0.005), and also 100% of the experimental group compared to 74 % in

control group said that they had received recommendation about eating fewer sweets from health professionals (p = 0.016); (2) in regard to exercise: 100% of the experimental group compared to 71.2% in control group said that they received recommendations about exercise frequently from from health professionals (p = 0.002); 100% of the experimental group compared to 74% in control group said that they received recommendations about exercising with time advice from health professionals (p = 0.003). On the other hand, there were 100% of the experimental group compared to 54.8% in control group who said that they received recommendations about to do exercise in daily routine from health professionals (p= 0.016). However, 0% of the experimental group compared to 19.2% in control group said that they received recommendations about exercise specified from health professionals (p = 0.035); (3) in testing blood glucose: 100% of the experimental group compared to 39.2% in control group said that they received recommendations about testing their blood glucose with machines from health professionals (p = 0.004), and 100% of the experimental group compared to 70.8% in control group said that they received recommendations about testing their blood glucose at health care services from health professionals (p = 0.032); (4) in foot care: 100% of the experimental group compared to 80.0% in control group said that they received recommendations about checking their feet daily from the previous week from health professionals (p = 0.048); 100% of the experimental group compared to 72.0% in control group said that they received recommendations about the importance of drying the gaps between their toes from health professionals (p = 0.005), and 100% of the experimental group compared to 58.4% control group said that they received recommendations about checking the inside of their shoes from health professionals (p = 0.005).

Comparisons of results of self-care activities with respect to medication between experimental (n=241) and control group (n=259) at 3 months follow-up showed no significant differences (Table 4.22). Most participants seemed to follow the orders of their health professional closely.

Table 4.17: Comparison of clinical characteristics between experimental (n=241) and control group (n=259) after 3 months follow-up.

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
Medical Record: HbA1C	Mean HbA1C (SD)**; missing 15	6.2 (1.3)	7.3 (4.0)	p<0.001	p=0.023
Medical Record: Blood glucose, AC	Mean Blood glucose, AC (SD); missing 24	133.5 (40.4)	165.3 (44.0)	p<0.001	p=0.002
Medical Record: Blood glucose, PC	Mean Blood glucose, PC (SD); missing 355	194.4 (63.7)	216.7 (58.2)	p=0.063	p=0.034
Medical Record: nephropathy assessment: BUN	Median BUN [IQR]***; missing 500	/[#]	/	/	/
Medical Record: nephropathy assessment: serum creatinine	Median serum creatinine [IQR]; missing 421	/	1.3 [1.2, 1.5]	/	/
Medical Record: nephropathy assessment: urine acid	Mean urine acid (SD); missing 499	/	/	/	/
Medical Record: nephropathy assessment: urine protein	urine protein equal 0; missing 451	/	34.7%	/	/
Medical Record: nephropathy assessment: urine glucose	urine glucose equal 0; missing 443	/	82.5%	/	/
Medical Record: nephropathy assessment: micro albumin	micro albumin [IQR]; missing 421	/	1.7 [1.5, 1.9]	/	/

Table 4.17 (continued): Comparison of clinical characteristics between experimental (n=241) and control group (n=259) after 3 months follow-up.

Item	Category	Experimental group	Control group	p-value	Adjusted p-value*
Medical Record: lipid profile: cholesterol	Mean cholesterol (SD); missing 419	/	190.1 (31.2)	/	/
Medical Record: lipid profile: LDL-C	Mean LDL-C (SD); missing 426	/	147.5 (13.1)	/	/
Medical Record: lipid profile: HDL-C	Mean HDL-C (SD); missing 426	/	74.2 (15.9)	/	/
Medical Record: lipid profile: triglyceride	Median triglyceride [IQR]; missing 417	/	168 [158, 178]	/	/
Medical Record: systolic blood pressure	Mean systolic blood pressure (SD); missing 15	131.4 (13.9)	139.7 (13.4)	p<0.001	p=0.037
Medical Record: diastolic blood pressure	Mean diastolic blood pressure (SD); missing 15	80.4 (8.2)	83.0 (10.0)	p=0.002	p=0.311
Medical Record: Ophthalmoscopic assessment	Ophthalmoscope assessment normal; missing 18	92.6%	79.0%	p<0.001	p=0.022
Medical Record: body weight	Mean body weight (SD); missing 15	63.5 (11.1)	64.7 (9.9)	p=0.203	p=0.465

*adjusted for cluster sampling strategy; **SD = standard deviation; ***IQR = inter-quartile range; [#]Comparisons not done because of lack of adequate sample size.

Table 4.18: Comparison of results of Health Perception Questionnaire between experimental (n=241) and control group (n=259) at 3 months of follow-up [17 missing].

	Experimental group (n=235)	**Control group (N=248)**	**p-value**	**Adjusted p-value***
Mean of total scale (SD)**	111.6 (9.2)	110.5 (11.1)	p=0.250	p=0.786
Mean of "current health" subscale (SD)	27.2 (5.8)	26.6 (7.0)	p=0.261	p=0.817
Mean of "prior health" subscale (SD)	8.9 (1.8)	8.4 (2.1)	p=0.017	p=0.369
Mean of "health outlook" subscale (SD)	15.2 (1.9)	15.2(2.4)	p=0.997	p=0.999
Mean of "resistance to illness" subscale (SD)	12.2 (1.9)	12.0 (2.2)	p=0.326	p=0.812
Mean of "health worry" subscale (SD)	19.1 (2.3)	18.9 (2.6)	p=0.479	p=0.831
Mean of "sickness orientation" subscale (SD)	4.1 (0.8)	4.1 (0.8)	p=0.851	p=0.899

*adjusted for cluster sampling strategy; **SD = standard deviation.

Table 4.19: Comparison of results of WHO quality of life questionnaire (Taiwan version) between experimental (n=241) and control group (n=259) at 3 months of follow-up [16 missing].

	Experimental group (n=235)	**Control group (n=249)**	**p-value**	**Adjusted p-value***
Mean of total score (SD)**	94.8 (11.1)	93.2 (11.8)	p=0.129	p=0.621
Mean of health related quality of life (SD)	70.3 (9.1)	65.9 (14.7)	p<0.001	p=0.336
Mean of quality of life before diagnosis with diabetes (SD)	75.1 (9.3)	75.3 (15.6)	p=0.852	p=0.969

*adjusted for cluster sampling strategy; **SD = standard deviation.

Table 4.20: Comparison of results of self-care activities between experimental (n=241) and control group (n=259) at 3 months of follow-up [15 missing].

Median number of days during last week [IQR]…	**Experimental group (n=235)**	**Control group (N=250)**	**p-value**	**Adjusted p-value***
…followed balanced food eating	4 [5, 6]	4 [2, 6]	p<0.001	p=.222
…followed eating plan	5 [3, 6]	4 [2, 5]	p<0.001	p=0.158
…ate high fat foods	2 [0, 5]	3 [0, 4]	p=0.055	p=0.403
…ate at least 5 dishes of fruit and vegetables	5 [4, 6]	4 [3, 6]	p<0.001	p=0.229
…participated in exercise for at least 30 minutes	4 [3, 7]	3 [0, 5]	p<0.001	p=0.035
…participated in specific exercise session	4 [2, 6]	2 [1, 4]	p<0.001	p=0.021
….tested blood glucose	1 [1, 3]	1 [0, 1]	p<0.001	p=0.025
…tested blood glucose according to doctor's guideline	1 [1, 2]	1 [0, 1]	p<0.001	p=0.005
….checked feet	4 [4, 7]	6 [2, 7]	p=0.155	p=0.939
…inspected inside of shoes	4 [3, 6]	3.5 [0, 7]	p=0.014	p=0.227
…washed feet	7 [7, 7]	7 [7, 7]	p=0.231	p=0.635
…dried gaps between toes	7 [6, 7]	6 [3, 7]	p<0.001	p=0.018
…smoked a cigarette	0 [0, 0]; range0-4 days	0 [0, 0]; range0-6 days	p=0.889	p=0.537

*adjusted for cluster sampling strategy; **SD = standard deviation.

Table 4.21: Comparison of results of self-care recommendations between experimental (n=241) and control group (n=259) at 3 months follow-up. [15 missing]

Who had been recommended by health care team to (a)….	**Experimental group (n=235)**	**Control group (N=250)**	**p-value**	**Adjusted p-value***
…balanced food eating plan	100%	70.4%	p<0.001	p=0.052
…eating plan with amount of foods	100%	50.4%	p<0.001	p=0.001
…low-fat eating plan	100%	55.2%	p<0.001	p=0.008
…reduce calories	100%	47.2%	p<0.001	p=0.004
…eat fruit and vegetables	100%	46.0%	p<0.001	p=0.005
…eat few sweets	100%	74.0%	p<0.001	p=0.016
No advice given about diet	0%	2.0%	p=0.062	p=0.259
….exercise frequently	100%	71.2%	p<0.001	p=0.002
…exercise with time advice	100%	74.0%	p<0.001	p=0.003
…exercise in daily routine	100%	54.8%	p<0.001	p=0.016
…exercise exactly specified	0%	19.2%	p<0.001	p=0.035
No advice given about exercise	0%	3.6%	p=0.004	p=0.269
…test blood glucose with machine	100%	39.2%	p<0.001	p=0.004
…test blood glucose at health care service	100%	70.8%	p<0.001	p=0.032
No advice about testing blood glucose	0%	6.0%	p<0.001	p=0.184
….check feet daily	100%	80.0%	p<0.001	p=0.048

Table 4.21 (continued): Comparison of results of self-care recommendations between experimental (n=241) and control group (n=259) at 3 months follow-up. [15 missing]				
Who had been recommended by health care team to (a)….	**Experimental group (n=235)**	**Control group (N=250)**	**p-value**	**Adjusted p-value***
…dry gaps between toes	100%	72.0%	p<0.001	p=0.005
…shoes for diabetes patients	100%	58.4%	p<0.001	p=0.002
No advice about foot care	0%	9.6%	p<0.001	p=0.218
Asked about smoking status	66.0%	54.0%	p=0.007	p=0.472
Smokers given advice on how to withdraw	24.7%	31.6%	p=0.436	p=0.135

*adjusted for cluster sampling strategy; **SD = standard deviation.

Table 4.22: Comparison of results of self-care activities with respect to medication between experimental (n=241) and control group (n=259) at 3 months follow-up [15 missing].

	Experimental group (n=235)	**Control group (N=250)**	**p-value**	**Adjusted p-value***
Doctor prescribed….				
…Insulin injection only	5.1%	8.0%	p=0.200	p=0.250
…Oral medication only	94.0%	94.0%	p=1	p=0.991
…Both insulin and oral medication	3.4%	4.0%	p=0.729	p=0.729
…neither insulin nor oral medication was prescribed	2.1%	1.2%	p=0.423	p=0.433
% with insulin shot 3 or more times per day	1.3%	0%	p=0.001	p=0.079
% with oral medication 3 or more times per day	3.8%	7.2%	p=0.269	p=0.766
Median number of days during last week [IQR]… (of people who take those medications!)				
…took recommended oral medication	7 [7, 7]; n=221	7 [7, 7];n=235	p=0.288	p=0.549
…took oral medication on time	7 [7, 7]; n=221	7 [7, 7]; n=23	p=0.012	p=0.381
…took recommended insulin injection	0 [0, 7]; n=12	7 [4.8, 7]; n=20	p=0.091	p=0.186

Table 4.22 (continued): Comparison of results of self-care activities with respect to medication between experimental (n=241) and control group (n=259) at 3 months follow-up [15 missing].				
	Experimental group (n=235)	**Control group (n=250)**	**p-value**	**Adjusted p-value***
Doctor prescribed….				
…took recommended insulin injection on time	0 [0, 7]; n=12	7 [4.8, 7]; n=20	p=0.091	p=0.099

*adjusted for cluster sampling strategy; **SD = standard deviation.

4.8 Results of comparisons at 6 months of follow-up

The outcome variables investigated at 6 months follow-up were the same as at 3 months of follow–up, namely including clinical characteristics, results of the Health Perception Questionnaire, result of self-care activities, results of self-care recommendation and results of the WHO quality of life questionnaire (Taiwan version).

Comparisons of clinical characteristics after 6 months of follow-up between experimental (n=241) and control group (n=259) are presented in Table 4.23. The following items showed significance: The mean HbA1C of the experimental group was 6.1 compared to 7.4 of participants in the control group ($p = 0.012$). The mean blood glucose (AC) record of the experimental group was 128.8 compared to 174.4 of the control group ($p < 0.001$). In nephropathy assessment for micro albumin, the two groups showed statistically significant differences ($p = 0.035$). In lipid profile: the mean cholesterol level of the experimental group was 184.8 compared to 201.6 of the control group ($p = 0.008$). The mean LDL-C record of the control group was 145.7 compared to 119.9 in the experimental group ($p < 0.001$). The mean triglyceride level of the experimental group was 106 compared to 171 of the control group ($p = 0.012$). The mean systolic blood pressure of the experimental group was 131.3 compared to

141.5 of the control group (p = 0.009). Finally, the ophthalmoscopic assessment result was normal in 92.5% of the experimental group and 79% of the control group (p = 0.025).

Similar as the results after 3 months of follow-up, comparisons of experimental (n=241) with control group (n=259) at 6 months of follow-up with respect to the Health Perception Questionnaire and the WHO quality of life questionnaire (Taiwan version) showed no statistically significant results (Table 4.24 and Table 4.25).

Results of comparisons between the experimental (n=241) and the control group (n=259) at 6 months of follow-up with respect to self-care activities are presented in Table 4.26. Participants were asked to remember the self-care activities they were engaged with during the previous week. The following items showed statistical significance:

(1) in eating habit: During the previous week, the experimental group had followed a median number of 5 days a balanced food eating compared to 4 days of the control group (p = 0.001). During the previous week, the experimental group had followed a median number of 5 days a food eating plan compared to 3 days of the control group (p = 0.001). During the previous week, the experimental group had followed a median number of 5 days at least 5 dishes of fruit and vegetables a day compared to 4 days of the control group (p = 0.013).

(2) In exercise : During the previous week, the experimental group had exercised a median number of 5 days for at least 30 minutes compared to 2 days for the control group (p = 0.008). During the previous week, the experimental group had participated a median number of 4 days in specific exercise sessions compared to 2 days for the control group (p = 0.007).

Results of comparisons between experimental (n=241) and control group (n=259) at 6 months of follow-up with respect to self-care recommendations are presented in Table 4.27. Similar as the 3 months follow-up comparisons, many items showed statistical significance:

(3) In eating habit recommendations: 100% of the experimental group compared to 78.3% in control group said that they receiving recommendation about balancing foot eating plan from health professors ($p = 0.028$). 100% of the experimental group compared to 52.2% in control group said that they receiving recommendation about eating plan with amount of foods health professors ($p = 0.003$). 100% of the experimental group compared to 56.6% control group said that they receiving recommendation about low-fat eating plan from health professors ($p= 0.005$). 100% of the experimental group compared to 48.6% in control group said that they receiving recommendation about reducing calories from health professors ($p = 0.002$). In addition, 100% of the experimental group compared to 44.2% in control group said that they receiving recommendation about eating fruit and vegetables from health professors ($p < 0.001$). 100% of the experimental group compared to 73.1% in control group said that they receiving recommendation about eating few sweets from health professors ($p = 0.026$).

(4) In exercise recommendation: 100% of the experimental group compared to 74.7% in control group said that they receiving recommendation about exercising frequently from health professors ($p = 0.043$) and 100% of the experimental group compared to 69.9% in control group said that they receiving recommendation about exercising with time advice from health professors ($p = 0.001$). Finally, 100% of the experimental group compared to 39.4% control group said that they receiving recommendation about exercising in daily routine from health professors ($p < 0.001$).

(5) In the test of blood glucose: 100% of the experimental group compared to 48.6% in control group said that they receiving recommendation about checking their blood glucose with machine from health professors ($p = 0.008$). 100% of the experimental group compared to 57% in control group said that they receiving recommendation about going to health care service check their blood glucose from health professors ($p < 0.001$).

(6) In foot care: 100% of the experimental group compared to 77.5% in control group aid that they receiving recommendation about checking their feet daily from health professors (p = 0.015). 100% of the experimental group compared to 65.1% in control group said that they receiving recommendation about drying gaps between toes from health professors (p = 0.002), and of the 100% experimental group said that they receiving recommendation about checking their shoes inside from health professors (p = 0.005).

Comparison of results of self-care activities with respect to medication between experimental (n=241) and control group (n=259) at 6 months follow-up are presented in Table 4.28. More than 90% of participants took oral medication and most participants followed their health professional's advice irrespective of the assigned group.

Table 4.23: Comparison of clinical characteristics between experimental (n=241) and control group (n=259) after 6 months of follow-up.

Item	**Category**	**Experimental group**	**Control group**	**p-value**	**Adjusted p-value***
Medical Record: HbA1C	Mean HbA1C (SD)**; missing 15	6.1 (1.3)	7.4 (1.4)	P<0.001	P=0.012
Medical Record: Blood glucose, AC	Mean Blood glucose, AC (SD); missing 29	128.8 (41.0)	174.4 (50.1)	P<0.001	P<0.001

Table 4.23 (continued): Comparison of clinical characteristics between experimental (n=241) and control group (n=259) after 6 months of follow-up.					
Item	**Category**	**Experimental group**	**Control group**	**p-value**	**Adjusted p-value***
Medical Record: Blood glucose, PC	Mean Blood glucose, PC (SD); missing 355	193.8 (49.0)	199.6 (49.8)	p=0.572	p=0.665
Medical Record: nephropathy assessment: BUN	Median BUN [IQR]***; missing 493	/	17 [15, 21]	/	/
Medical Record: nephropathy assessment: serum creatinine	Median serum creatinine [IQR]; missing 97	0.8 [0.7, 1.1]	1.1 [0.8, 1.3]	p<0.001	p=0.117
Medical Record: nephropathy assessment: urine acid	Mean urine acid (SD); missing 482	5.6 (1.6)	5.2 (2.0)	p=0.733	p=0.664
Medical Record: nephropathy assessment: urine protein	Urine protein equal 0; missing 171	100%	76.9%	p<0.001	p=0.240

Table 4.23 (continued): Comparison of clinical characteristics between experimental (n=241) and control group (n=259) after 6 months of follow-up.					
Item	**Category**	**Experimental group**	**Control group**	**p-value**	**Adjusted p-value***
Medical Record: nephropathy assessment: urine glucose	Urine glucose equal 0; missing 155	100%	94.2%	p=0.003	p=0.283
Medical Record: nephropathy assessment: micro albumin	Median micro albumin [IQR]; missing 112	0 [0, 0]	0 [0, 2.1]	p<0.001	p=0.035
Medical Record: lipid profile: cholesterol	Mean cholesterol (SD); missing 92	184.8 (33.6)	201.6 (39.3)	p<0.001	p=0.008
Medical Record: lipid profile: LDL-C	Mean LDL-C (SD); missing 311	119.9 (34.1)	145.7 (30.2)	p<0.001	p<0.001
Medical Record: lipid profile: HDL-C	Mean HDL-C (SD); missing 298	45.9 (15.8)	62.5 (26.1)	p<0.001	p=0.207

Table 4.23 (continued): Comparison of clinical characteristics between experimental (n=241) and control group (n=259) after 6 months of follow-up.					
Item	**Category**	**Experimental group**	**Control group**	**p-value**	**Adjusted p-value***
Medical Record: lipid profile: triglyceride	Median triglyceride [IQR]; missing 94	106 [84.5. 162.5]	171 [115, 186]	p<0.001	p=0.012
Medical Record: systolic blood pressure	Mean systolic blood pressure (SD); missing 16	131.3 (13.2)	141.5 (13.7)	p<0.001	p=0.009
Medical Record: diastolic blood pressure	Mean diastolic blood pressure (SD); missing 16	79.7 (8.0)	83.2 (9.2)	p<0.001	p=0.165
Medical Record: Ophthalmoscope assessment	Ophthalmoscope assessment normal; missing 26	92.5%	79.0%	p=0.001	p=0.025
Medical Record: body weight	Mean body weight (SD); missing 16	63.5 (10.9)	65.0 (9.8)	p=0.115	p=0.366

*adjusted for cluster sampling strategy; **SD = standard deviation; ***IQR = inter-quartile range; [#]Comparisons not done because of lack of adequate sample size.

Table 4.24: Comparison of results of Health Perception Questionnaire between experimental (n=241) and control group (n=259) at 6 months of follow-up [17/18 missing].

	Experimental group (n=234)	**Control group (N=249)**	**p-value**	**Adjusted p-value***
Mean of total scale (SD)**	111.5 (9.1)	110.9 (10.2)	p=0.514	p=0.856
Mean of "current health" subscale (SD)	27.2 (5.6)	28.5 (5.9)	p=0.013	p=0.393
Mean of "prior health" subscale (SD)	8.9 (1.8)	8.9 (1.7)	p=0.873	p=0.933
Mean of "health outlook" subscale (SD)	15.1 (2.0)	14.5 (2.3)	p=0.003	p=0.227
Mean of "resistance to illness" subscale (SD)	12.4 (1.7)	12.0 (2.2)	p=0.026	p=0.631
Mean of "health worry" subscale (SD)	18.9 (2.3)	18.7 (2.6)	p=0.281	p=0.698
Mean of "sickness orientation" subscale (SD)	4.2 (0.8)	4.2 (0.7)	p=0.406	p=0.691

*adjusted for cluster sampling strategy; **SD = standard deviation.

Table 4.25: Comparison of results of WHO quality of life questionnaire (Taiwan version) between experimental (n=241) and control group (n=259) at 6 months of follow-up [16/17 missing].

	Experimental group (n=234)	**Control group (N=249)**	**p-value**	**Adjusted p-value***
Mean of total score(SD)**	95.6 (11.9)	92.9 (12.2)	p=0.017	p=0.466
Mean of health related quality of life (SD)	71.8 (10.1)	69.3 (10.9)	p=0.010	p=0.278
Mean of quality of life before diagnosis with diabetes (SD)	76.3 (9.8)	78.3 (10.9)	p=0.041	p=0.398

*adjusted for cluster sampling strategy; **SD = standard deviation.

Table 4.26: Comparison of results of self-care activities between experimental (n=241) and control group (n=259) at 6 months follow-up. [16 missing].

Median number of days during last week [IQR]…	**Experimental group (n=235)**	**Control group (N=249)**	**p-value**	**Adjusted p-value***
…followed balanced food eating	5 [4, 6]	4 [2, 5.5]	p<0.001	p=0.001
…followed eating plan	5 [4, 6]	3 [2, 5]	p<0.001	p=0.001
…ate high fat foods	3 [0, 5]	3 [0, 4]	p=0.333	p=0.724
…ate at least 5 dishes of fruit and vegetables	5 [4, 6]	4 [3, 5]	p<0.001	p=0.013
…participated in exercise for at least 30 minutes	5 [3, 6]	2 [1, 5]	p<0.001	p=0.008
…participated in specific exercise session	4 [2, 6]	2 [0, 3.5]	p<0.001	p=0.007

Table 4.26 (continued): Comparison of results of self-care activities between experimental (n=241) and control group (n=259) at 6 months follow-up. [16 missing].

Median number of days during last week [IQR]…	**Experimental group (n=235)**	**Control group (N=249)**	**p-value**	**Adjusted p-value***
….tested blood glucose	1 [1, 3]	0 [0, 2]	p<0.001	p=0.183
…tested blood glucose according to doctor's guideline	1 [0, 2]	0 [0, 1]	p<0.001	p=0.124
….checked feet	4 [3, 7]	4 [2, 7]	p=0.078	p=0.302
…inspected inside of shoes	4 [3, 6]	4 [0, 6]	p=0.007	p=0.257
…washed feet	7 [7, 7]	7 [7, 7]	p=0.518	p=0.808
…dried gaps between toes	7 [6, 7]	6 [3, 7]	p<0.001	p=0.100
…smoked a cigarette	0 [0, 0]	0 [0, 0]	p=0.344	p=0.762

*adjusted for cluster sampling strategy; **SD = standard deviation.

Table 4.27: Comparison of results of self-care recommendations between experimental (n=241) and control group (n=259) at 6 months follow-up [16 missing].

Who had been recommended by health care team to (a)….	**Experimental group (n=235)**	**Control group (N=249)**	**p-value**	**Adjusted p-value***
…balanced food eating plan	100%	78.3%	p<0.001	p=0.028
…eating plan with amount of foods	100%	52.2%	p<0.001	p=0.003
…low-fat eating plan	100%	56.6%	p<0.001	p=0.005
…reduce calories	100%	48.6%	p<0.001	p=0.002
…eat fruit and vegetables	100%	44.2%	p<0.001	p<0.001

Table 4.27 (continued): Comparison of results of self-care recommendations between experimental (n=241) and control group (n=259) at 6 months follow-up [16 missing].

Who had been recommended by health care team to (a)….	**Experimental group (n=235)**	**Control group (N=249)**	**p-value**	**Adjusted p-value***
…eat few sweets	100%	73.1%	p<0.001	p=0.026
No advice given about diet	0%	1.2%	p=0.249	p=0.396
….exercise frequently	100%	74.7%	p<0.001	p=0.043
…exercise with time advice	100%	69.9%	p<0.001	p=0.001
…exercise in daily routine	100%	39.4%	p<0.001	p<0.001
…exercise exactly specified	0%	16.1%	p<0.001	p=0.070
no advice given about exercise	0%	1.2%	p=0.249	p=0.273
…test blood glucose with machine	100%	48.6%	p<0.001	p=0.008
…test blood glucose at health care service	100%	57.0%	p<0.001	p<0.001
no advice about testing blood glucose	0%	3.2%	p=0.006	p=0.238
…check feet daily	100%	77.5%	p<0.001	p=0.015
…dry gaps between toes	100%	65.1%	p<0.001	p=0.002
…shoes for diabetes patients	100%	67.1%	p<0.001	p=0.005
No advice about foot care	0%	7.2%	p<0.001	p=0.259
Asked about smoking status	65.1%	69.9%	p=0.262	p=0.752
Smokers given advice on how to withdraw (n=101)	22.2%	26.3%	p=0.640	p=0.776

*adjusted for cluster sampling strategy; **SD = standard deviation.

Table 4.28: Comparison of results of self-care activities with respect to medication between experimental (n=241) and control group (n=259) at 6 months follow-up [16 missing].

	Experimental group (n=235)	**Control group (N=249)**	**p-value**	**Adjusted p-value***
% Doctor prescribed….				
…Insulin injection only	6.0%	6.8%	p=0.696	p=0.681
…Oral medication only	93.6%	96.4%	p=0.161	p=0.372
…Both insulin and oral medication	3.8%	4.0%	p=0.916	p=0.934
…neither insulin nor oral medication was prescribed	1.7%	0.8%	p=0.438	p=0.387
with insulin shot 3 or more times per day	2.1%	0%	p=0.004	p=0.045
with oral medication 3 or more times per day	8.1%	7.6%	p=0.635	p=0.886
Median number of days during last week [IQR]… (of people who take those medications!)				
…took recommended oral medication	7 [7, 7]; n=220	7 [7, 7];n=240	p=0.355	p=0.606
…took oral medication on time	7 [7, 7]; n=220	7 [7, 7]; n=24	p=0.289	p=0.633
…took recommended insulin injection	7 [0, 7]; n=14	7 [0, 7]; n=17	p=0.739	p=0.391

Table 4.28 (continued): Comparison of results of self-care activities with respect to medication between experimental (n=241) and control group (n=259) at 6 months follow-up [16 missing].

	Experimental group (n=235)	**Control group (N=249)**	**p-value**	**Adjusted p-value***
% Doctor prescribed….				
…took recommended insulin injection on time	7 [0, 7]; n=14	7 [0, 7]; n=17	p=0.710	p=0.427

*adjusted for cluster sampling strategy; **SD = standard deviation

4.9 Results of the multivariate analysis

Multivariate analysis was necessary because of the discovered differences between experimental and control group at baseline. The multivariate analysis focussed on the self-care activities at 6 months of follow-up and the differences between the experimental and control group. A total of five multivariate models were considered: The first two models, one for eating and one for exercise, are summarized in the self-care habits of the participants; Models 3 to 5 summarize the self-care recommendations the participants had received, one for eating recommendations, one for exercise recommendations, and one for other technical aspects of recommendations received regarding self-care.

The five outcome variables (self-care eating and exercise; and advice of self-care recommendations received on eating, exercise and technical aspects) at six months of follow-up have to be similar at baseline, for the five models above to hold. Otherwise those models will need adjustment.

Table 4.29: Comparisons of the combined outcome characteristics at baseline (adjusted for cluster sampling approach):

Outcome characteristic at baseline	**Intervention**	**Control**	**p-value**	**p-value adjusted***
Mean score of eating correctly (SD)**	2.74 (0.40)	2.68 (0.47)	p=0.133	p=0.481
Mean score of exercising correctly (SD)	1.86 (0.83)	1.45 (1.00)	p<0.001	p=0.030
Mean score for being given correct advice on eating behaviour (SD)	1.14 (0.62)	1.37 (0.47)	p<0.001	p=0.042
Mean score for being given correct advice on exercising behaviour (SD)	0.84 (0.52)	0.97 (0.42)	p=0.002	p=0.274
Mean score for being given correct advice on other technical aspects (measuring blood glucose, foot care, smoking) (SD)	1.65 (0.36)	1.65 (0.32)	p=0.004	p=0.232

*Adjusted for cluster sampling approach; **SD = standard deviation

According to these results (Table 4.28) at least models 2 and 3 need adjustment for baseline values. Below are the five models all adjusted for the baseline values.

Table 4.30: Result of multivariate analysis of influence of intervention on self-care activities related to correct eating habits (summary of questions 1 to 4 of SDSCA scale). Results are based on 473 Taiwanese diabetes patients and were adjusted for the cluster sampling approach and baseline value of outcome.

Characteristic	**Coefficient**	**95%-confidence interval**	**p-value**
Intervention	0.190	[0.098, 0.281]	p=0.001
Highest level of education was College, University or above	0.190	[0.033, 0.347]	p=0.022
Being diagnosed with diabetes for more than 10 years	0.069	[0.018, 0.121]	p=0.013
Total score of health perception questionnaire	0.004	[0.001, 0.008]	p=0.026
Received main help for diabetes through health care service	0.120	[0.084, 0.157]	p<0.001
Current treatment is diet control only	0.129	[0.018, 0.240]	p=0.027
Baseline value of self-care activities related to correct eating habits	0.210	[-0.004, 0.423]	p=0.053

The model was adjusted for the confounding effects of ethnicity (confounded “Received main help for diabetes through health care service”), living alone (confounded intervention and “Received main help for diabetes through health care service”), monthly income (confounded level of education), and having a diabetes passport (confounded intervention).

Multiple linear regression analysis showed that people in the intervention group were more likely to score higher on the score of self-care activities related to correct eating habits (p=0.001). In comparison to other participants, people whose highest level of education was college, university, or above were more likely to score higher on the scale of self-care activities related to correct eating habits (p=0.022). Similarly, participants who had been diagnosed with diabetes for more than 10 years scored higher on the scale of self-care activities related to correct eating habits (p=0.013). Participants with a higher total score on the health perception questionnaire also had a higher score on the scale of self-care activities related to correct eating habits (p=0.026). In comparison to others, participants who received their main help for diabetes over the last year through a health care service scored higher on the scale of self-care activities related to correct eating habits (p<0.001). Participants whose current treatment is diet related only scored also higher scored higher on the scale of self-care activities related to correct eating habits (p=0.027).

Table 4.31: Result of multi-variable regression analysis of influence of intervention on self-care activities related to exercise habits (summary of questions 5 and 6 of SDSCA scale). Results are based on 472 Taiwanese patients with Type 2 diabetes and were adjusted for the cluster sampling approach and baseline value of outcome.

Characteristic	**Coefficient**	**95%-confidence interval**	**p-value**
Intervention	0.346	[0.039, 0.652]	p=0.030
Received main help for diabetes through health care service	0.271	[0.042, 0.502]	p=0.025
Baseline value of self-care activities related to exercise habits	0.248	[0.057, 0.439]	p=0.016

The model was adjusted for the confounding effects of ethnicity (confounded intervention), and age (confounded “Received main help for diabetes through health care service”).

Multiple linear regression analysis showed that people in the intervention group were more likely to score higher on the score of self-care activities related to exercise habits (p=0.030). In comparison to other participants, people whose received their main help for diabetes through health care services were more likely to score higher on the scale of self-care activities related to exercise habits (p = 0.025). Participants whose baseline value of self-care activities related to exercise habits were more likely to score higher on the scale of self-care activities related to exercise habits (p = 0.016).

Table 4.32: Result of multi-variable regression analysis of influence of intervention on self-care activities related to eating habits as recommended by health care team (summary of question 1 of self care recommendations). Results are based on 473 Taiwanese diabetes patients and were adjusted for the cluster sampling approach and baseline value of outcome.

Characteristic	**Coefficient**	**95%-confidence interval**	**p-value**
Intervention	0.519	[0.396, 0.642]	p<0.001
Baseline value of self-care activities related to eating habits as recommended by health care team	0.132	[-0.071, 0.334]	p=0.181

The model initially included the duration of diabetes (p=0.042), whether the patient had a diabetes passport (p=0.029), and the place they had received help for their disease (p=0.047). However, when the model was adjusted for confounding variables, these three variables were no longer significantly related to the outcome. Main confounders were age, whether they had an educational service in their community, and whether they had any diabetes complications.

Multiple linear regression analysis showed that people in the intervention group were more likely to score higher on the score of self-care activities related to eating habits as recommended by the health care team (p<0.001).

Table 4.33: Result of multi-variable regression analysis of influence of intervention on self-care activities related to exercise habits as recommended by health care team (summary of question 2 of self care recommendations). Results are based on 430 Taiwanese diabetes patients and were adjusted for the cluster sampling approach and baseline value of the outcome.

Characteristic	**Coefficient**	**95%-confidence interval**	**p-value**
Intervention	0.367	[0.300, 0.434]	p<0.001
Received main help for diabetes through hospital	0.071	[0.011, 0.132]	p=0.026
Holding a diabetes patient passport	0.027	[-0.010, 0.065]	p=0.135*
Baseline value of self-care activities related to exercises as recommended by health care team	0.137	[-0.071, 0.346]	p=0.175

The model was adjusted for the confounding effects of living alone (confounded “Received main help for diabetes through hospital”), and have diabetes complication (confounded “Received main help for diabetes through hospital” and “Holding a diabetes patient passport”).

*Holding a diabetes patient passport was significant (p=0.045) before the model was adjusted for the baseline values of the outcome.

Multiple linear regression analysis showed that people in the intervention group were more likely to score higher on self-care activities related to exercise habits as recommended by the

health care team (p<0.001). In comparison to other participants, people whose received main help for diabetes through hospital were more likely to score higher on the scale of self-care activities related to exercise habits as recommended by health care team (p = 0.026).

Table 4.34: Result of multi-variable regression analysis of influence of intervention on self-care activities related to other aspects (testing of blood glucose, care of feet, smoker) as recommended by health care team (summary of questions 3, 7 and 8 of self care recommendations). Results are based on 468 Taiwanese diabetes patients and were adjusted for the cluster sampling approach and baseline value of outcome.

Characteristic	**Coefficient**	**95%-confidence interval**	**p-value**
Intervention	0.341	[0.216, 0.466]	p<0.001
Blood glucose (AC) at baseline[#]	0.0004	[-0.00005, 0.0008]	p=0.075
Being diagnosed with diabetes for more than 10 years	-0.060	[-0.105, -0.015]	p=0.013
Baseline value of self-care activities related to other technical aspects (measuring blood glucose, foot care, smoking) as recommended by health care team	0.214	[-0.056, 0.484]	p=0.109

The model was adjusted for the confounding effects of age (confounded “Being diagnosed with diabetes for more than 10 years”), “Received main help for diabetes through …..” (Confounded “Blood glucose (AC) at baseline”), “being hospitalised for intensive treatment of diabetes during past year” (confounded “Being diagnosed with diabetes for more than 10 years”), and level of education (confounded “Being diagnosed with diabetes for more than 10 years”).

[#]Blood glucose (AC) at baseline was statistically significant (p=0.039) before model was adjusted for confounding.

Multiple linear regression analysis showed that people in the intervention group were more likely to score higher on self-care activities related to other aspects (testing of blood glucose, caring for feet, smoking habit) as recommended by health care team ($p<0.001$). In comparison to other participants, people who were diagnosed with diabetes for more than 10 years were less likely to score higher on the scale of self-care activities related to other aspects (testing of blood glucose, caring for feet, smoking habits) as recommended by health care team ($p = 0.013$).

4.10 Results addressing the main hypotheses

Main hypothesis 1

Comparing percentage of patients who have blood glucose level in normal range (AC 70-110 mg/dl or PC 90-140 mg/dl): At baseline 88.4% in the control group and 78.8% in the experimental group had a blood glucose level above normal range ($p = 0.076$; adjusted for cluster sampling).

At 6-months of follow up 92.4% in the control group and 60.4% in the experimental group had a blood glucose level above normal range ($p < 0.001$; adjusted for cluster sampling).

Multivariate logistic regression (adjusted for cluster sampling) was conducted to allow adjustment for potential confounding and the baseline difference between intervention and control group.

Table 4.35: Result of multi-variable logistic regression analysis of influence of intervention on blood glucose (normal versus not normal level; normal level AC 70-110 or PC 90-140) at 6 months of follow-up. Results are based on 485 Taiwanese diabetes patients and were adjusted for the cluster sampling approach.

Characteristic	Blood glucose at 6 months follow-up		Odds-ratio [95%-CI]*	p-value
	Normal (n=112)	Above normal (n=373)		
Control	19	231	1	
Intervention	93	142	0.09 [0.03, 0.33]	=0.002
Blood glucose level at baseline				
Normal	47	31	1	
Above normal	65	342	9.0 [3.8, 21.3]	< 0.001
Average monthly income	continuous		1.0 [1, 1]	< 0.001
Occupation				
None	72	257	1	
Yes	40	116	0.53 [0.25, 1.1]	=0.089
Aboriginal Taiwanese				
No	89	328	1	
Yes	23	45	0.43 [0.21, 0.92]	=0.032

*95%-CI = 95%-confidence interval;

The model was adjusted for the confounding effects of gender (confounded occupation). Occupation was significant before adjustment for gender (p = 0.047).

Patients in the intervention group were 11.1 times less likely to show blood glucose levels above normal at 6 months follow-up compared to patients in the control group (p=0.002). Patients with above normal blood glucose levels at baseline were 9.0 times more likely to also show above normal levels at 6 months of follow-up (p<0.001).

Main hypothesis 2

The following markers for complications were considered: Creatinine (0.6 – 1.5), urine analysis (protein and glucose both 0), microalbumin (all normal at baseline < 30), Cholesterol (130 – 225), Triglyceride (50 – 130), blood pressure (above 160 to 95), and cataract or retinopathy. The number of markers for complications can range from 0 to 7.

At baseline the range of number of markers for complications was 0-5; median number 1, IQR = [0, 2]. The control group (median number 1; IQR = [1, 2]) had significantly more positive markers for complications at baseline compared to intervention group (median number 0; IQR = [0, 1]; p = 0.010). At baseline, 42.0% of the intervention compared to 82.1% of control group had positive markers for complications (p=0.003).

At 6 months follow-up the range of number of complications was 0-4; median number 1, IQR = [0, 2]. The control group (median number 2; IQR = [1, 2]) had significantly more positive markers for complications at 6 months follow-up compared to intervention group (median number 0; IQR = [0, 1]; p = 0.002). At 6 months follow up, 48.4% of the intervention compared to 87.0% of control group had positive markers for complications (p=0.006).

Multivariate logistic regression (adjusted for cluster sampling) was conducted to allow adjustment for potential confounding and the baseline difference between intervention and control group.

Table 4.36: Result of multi-variable logistic regression analysis of influence of intervention on prevalence of markers positive for complications of diabetes* at 6 months of follow-up. Results are based on 392 Taiwanese diabetes patients and were adjusted for the cluster sampling approach.

	Markers of complications at 6 months follow-up			
Characteristic	No (n=123)	Yes (n=269)	Odds-ratio [95%-CI]**	p-value
Control	28	179	1	
Intervention	95	90	0.28 [0.12, 0.68]	=0.009
Markers of complications at baseline				
None	105	27	1	
Some	18	242	44.3 [14.9, 131.9]	<0.001

*Markers considered were creatinine (0.6 – 1.5), urine analysis (protein and glucose both 0), microalbumin (all normal at baseline < 30), Cholesterol (130 – 225), Triglyceride (50 – 130), blood pressure (above 160 to 95), and cataract or retinopathy; **95%-CI = 95%-confidence interval; The model was adjusted for the confounding effects of living arrangements (confounded the effect of the intervention).

Patients in the intervention group were 3.6 times less likely to have some positive markers for complications of diabetes at 6 months follow-up compared to patients in the control group (p=0.009). Patients with some positive markers for complications at baseline were 44.3 times more likely to also show some positive markers for complications at 6 months of follow-up (p<0.001).

To further validate the above multivariate result a bivariate analysis selecting only participants without any complications at baseline was conducted. This analysis showed that of the 36 control patients without any complications at baseline, 14 (38.9%) developed incident complications during follow-up, while of the 96 intervention patients 13 (13.5%) developed complications (p=0.003).

4.11 Summary

This chapter has presented a description of the sample, descriptive and statistical findings related to the four research purposes of this study:

(1) A specially designed health care package will have a significant effect on patient with Type 2 diabetes mellitus. The patients are Aboriginal and non-Aboriginal older adults in Taiwan. It was hypothesized that the percentage of patients with well controlled blood glucose levels will increase from about 60% to 80% because of the health care package;

(2) A health care package will encourage lifestyle change for Taiwanese Aboriginal and non-Aboriginal older adults with Type 2 diabetes and will therefore decrease their diabetic complications markers by 20%;

(3) A health care package will result in increases in exercise, healthy diet choices and better blood glucose management and will therefore lead to a better overall quality of life; and

(4) Different cultural and lifestyles of Aboriginal and non-Aboriginal older adults with Type 2 diabetes will affect their disease perception of the study.

The intervention was able to improve the control of participants' blood glucose levels. The quantitative data analysis showed that a health care package had strong associations with well controlled blood glucose levels. Well controlled blood glucose includes diet control, regular exercise and taking medication as monitored by HbA1C. From the data it was shown that the

experimental group had followed balanced food eating for more days, eaten their planned fruit and vegetables, participated in exercise for at least 30 minutes, and participated in specific exercise sessions during the previous week more than the control group. We also compared the percentage of patients who had blood glucose levels in normal range (AC 70-110 or PC 90-140), and found that in the experimental group the percentage of well controlled blood glucose levels increased from about 20% to 40%.

According to the data analysis, we concluded that the specially designed health care package decreased the rate at which diabetic complications of participants developed. Our research findings from the current study further validate the theory that exposure to diabetes education relates to decrease in the rate of diabetes complications.

CHAPTER 5: DISCUSSION

5.1 Introduction

This chapter of the thesis presents the interpretation of the findings of the study, links the findings back to previous research results, presents an overview of its theoretical and methodological issues, and addresses the implications for nursing education, practice, and research.

5.2 Summary of the study

The study was a cluster randomized controlled clinical trial of an educational intervention to improve self-care of older diabetic patients in Taiwan. The patients were Aboriginal and non-Aboriginal older adults in Taiwan. The necessary sample size of 500 participants was based on two major hypotheses. It was hypothesized that the percentage of patients with well controlled blood glucose levels will increase from about 60% to 80% because of delivery of the health care package. Secondly, it was also hypoethisized that the health care package will encourage lifestyle change for Taiwanese Aboriginal and non-Aboriginal older adults with Type 2 diabetes and will therefore decrease their markers for diabetic complications from 50% to 30%. Markers for diabetic complications considered were: (1) Micro-vascular disease including diabetic retinopathy, cataract, and stroke, leg vessel disease, and protein urine; (2) Diabetic peripheral neuropathy; (3) Macro-vascular disease that includes ischaemic heart disease, arterial insufficiency, and medical arterial calcification. Secondary Hypotheses included: Firstly, a health care package will result in an increase in exercise, healthy diet choices and better blood glucose management and will therefore lead to a better overall quality of life. Secondly, the different cultural aspects and lifestyles of Aboriginal and non-Aboriginal older adults with Type 2 diabetes will affect their disease perception. A total of 235 participants in the experimental group and 250 participants in the control group were followed up for 3 and 6 months after the introduction of the intervention.

The research hypotheses of this study focused on the effects of a health care package on knowledge, attitudes and self-care behaviours of older Taiwanese Aboriginal and non-aboriginal adults with Type 2 diabetes in Taiwan. The most important findings of this study emerged from the comparison of the two groups which showed that a special health care package designed by the author had a significant effect on patients with Type 2 diabetes mellitus. This has not been investigated or demonstrated in previous research. The theoretical basis for the first major research hypothesis is that the experimental group who followed a specially designed a health care package would improve their diabetes knowledge, attitudes and behaviours and would thereby improve the control of their blood glucose. The health care package provided to the participants included resources to prevent diabetes complications, to assist with the design of an optimal daily diet, encouraged regular exercise and the regular taking of medications. In addition, this health care package introduced important diabetes support systems to decrease the participants' stress.

It was considered that the health care package should be able to improve the control of the participants' blood glucose levels. Comparing the percentage of patients who have blood glucose level in normal range (AC 70-110 mg/dl or PC 90-140 mg/dl), quantitative data analysis showed that the delivery of a health care package had strong associations with well controlled blood glucose levels. For those older people, self-care and nursing care for diabetes self-care activity is a matter that needs to be incorporated into activities of daily living. In this study, the researcher designed a health care package which focused on how to do self-care and nursing care required for people with diabetes which differed from other diabetes education programs in Taiwan.

Previously published programs focus primarily on lecture type teaching and do not include daily care activities as did the intervention used in this study (Miller 1999; Jenum et al. 2006; Aifl 2008; Marina et al. 2004; Lieb 2008; Habel 2006; Rankin et al.2005; Mulcahy 2003 etc.). Secondly, strategies for controlled blood glucose includes diet control, regular exercise and taking medicine. From the data collected, it was revealed that the experimental group reported they had followed the guidelines for balanced food planning and eating fruit and vegetables on many more days than the control group. They were also more likely to have participated in exercise for at least 30 minutes a day, and participated in specific exercise sessions during the previous week when compared to the control group. Percentages of participants who had blood glucose level in the normal range (AC 70-110 or PC 90-140) were also compared and the findings revealed that the experimental group had well controlled blood glucose levels which increased from about 20% to 40% because of delivery of the health care package. This is relevant as it demonstrates that the educational intervention had an overall positive impact on the participant's blood glucose level, one of the main indicators of diabetes control and hence strongly implicated in diabetes complications. This will be discussed further below.

Participants who were enrolled in the experimental group and participated in the health care package decreased the rate of diabetic complications. According to the data analysis, it is concluded that the specially designed health care package might be able to decrease the diabetic complications of the participants.

The Diabetes Control and Complications Trial (DCCT) found that improved blood glucose control markedly reduced the risk for retinopathy, nephropathy, and neuropathy (Clark et al. 2001). Epidemiological analysis of the UKPDS data showed that for every 1% reduction in HbA1c, the relative risk for microvascular complications decreased by 37%, diabetes-related deaths by 21%, and myocardial infarction by 14%. A recent study conducted in a staff model health maintenance organization found that a sustained reduction in HbA1c levels among adult

patients with diabetes was associated with significant cost savings within 1 to 2 years of improvement (Clark et al. 2001). In addition, Braiotta (2007) concurred that previous studies had proven that people who manage their blood glucose can significantly reduce the onset and severity of complications. The Diabetes Education and Treatment Center (2007) implemented an outpatient education program recognized by the American Diabetes Association, designed to provide patients with the necessary knowledge and skills for successful diabetes self-management. In the programme, patients are shown the significant role they play in self-management of their illness, and in maintaining the delicate balance between diet, exercise and medication. They receive individual and/or group instruction on topics such as: understanding diabetes, how medications and insulin work, blood glucose monitoring, diet and nutrition, complications, exercise, managing stress and coping with psychosocial issues. Most sessions are taught by a Registered Nurse and a Registered Dietitian, both of whom are Certified Diabetes Educators. Patients can receive anywhere between 4-15 hours of education over a two to three month time period. Physicians are kept informed of their patient's progress, and patients are encouraged to pursue routine follow up care with their physician, especially HbA1c testing. The HbA1c test is an indicator of blood glucose control over a two to three month period. After mastering the lessons of diabetes self management, most patients saw a decrease in their HbA1c. However, Tarr (2003) pointed out that strict glycemic control requires close attention to multiple behaviors including diet and physical activity, blood glucose monitoring, and medication use. Many people are faced with barriers that make these behaviors difficult. Further, educational programs are a significant demand on health care providers, requiring large blocks of time, specific training, teaching and communication skills, a supportive attitude, and a readiness to listen and negotiate (Gagliardino & Etchegoyen 2001). However, given the evidence that demonstrates their effectiveness, an educational programme was considered an ideal way to attempt to change the multiple behaviours involved in the management of elderly people’s diabetes in Taiwan.

The theoretical basis for the study's first major research hypothesis was that the experimental group who followed a specially designed health care package would improve their diabetes knowledge, attitudes and behaviours and would thereby improve the control of their blood glucose. The provided health care package gave resources to prevent diabetes complications, allowed the design of an optimal daily diet, encouraged regular exercise and medication adherence. In addition, this health care package also introduced important diabetes support systems to decrease participants' stress. The health care package was considered capable of helping the subjects to improve the control of their blood glucose levels. The findings are similar to those of Lo (2007), who investigated the dietary intake and anti-oxidative vitamin intake within Type 2 diabetic patients. A cross-sectional epidemiological study of subjects aged 40-65 years, with Type 2 diabetes for more than three years, were recruited and a total of 104 subjects (57 men and 47 women) completed the questionnaire. The dietary nutrient intake was assessed by 24-hour dietary recalls and semi-quantitative food frequency questionnaire, and the correlation between anti-oxidative vitamin intake and diabetic glycemic control (glycated hemoglobin A1c, HbA1c), and incidence of microvascular and macrovascular complications were analyzed. The results of their study (Lo 2007) showed that the average intake of energy of Type 2 diabetes patients was 1691 Kcal. The energy content of carbohydrate, protein and fat were 49, 13.5 and 37.5% of total energy intake. The average intake of vitamin C and vitamin E was 179.1 mg and 21.6 mg, respectively, which were higher than the recommendation for healthy adults as compared to the Taiwanese Dietary Reference Intakes (DRIs) and NAHSIT (1993-1996). The results of the study indicate that intake of anti-oxidative vitamins below recommendation may increase the risk to develop cardiovascular complications. Intake of anti-oxidative vitamins in Type 2 diabetes patients is well above the recommendation for healthy subjects. However, in order to prevent thrombogenic complications, intake of vitamin C

and vitamin E supplements may have beneficial effects for patients with Type 2 diabetes mellitus (Lo 2007).

Comparing the percentage of patients who had blood glucose level in the normal range (AC 70-110 or PC 90-140), the data analysis showed that a health care package had strong associations with well controlled blood glucose levels. At baseline 88.4% in the control group and 78.8% in the experimental group had a blood glucose level above normal range ($p = 0.076$; adjusted for cluster sampling). At the 6-months follow up, 92.4% in the control group and 60.4% in the experimental group had a blood glucose level above normal range ($p < 0.001$; adjusted for cluster sampling). There was an improvement of controlling diabetes demonstrating that an educational programme can improve blood glucose control.

A study using a special health care package designed by the researcher that had a significant effect on patient with Type 2 diabetes mellitus, has not been done with the target groups of elderly people with diabetes in Taiwan. In this study, the researcher specially designed a health care package suitable for elderly groups of Taiwanese people, namely the experimental groups. It focused on how to perform self-care and nursing practice and included sessions on adapting recipes and diabetes cooking classes, encouraged and monitored exercise, select suitable food, shoes, foot care etc. The sessions were delivered by nurse educators in interactive style, using small group teaching sessions. It differed from diabetes educational programmes previously utilized in Taiwan as they have tended to focus on lecture style teaching and focused on knowledge. This study had a significant impact because it offered a different approach that was not only planned to affect the patient’s knowledge, but also designed to change their attitude and self-care behaviours.

Several studies support these research findings. The study by Pibernik-Okanovic et al. (2004), for example, in which 73 patients undertook an empowerment-based psychosocial intervention, found that glycemic control and quality of life improved and remained so after 3 and 6 month follow-up periods. Van den Arend et al. (2000), in an educational intervention study designed to test knowledge, self care behaviour and disease perception, showed that the intervention group increased their knowledge and self care behaviour, but demonstrated no change in disease perception. Sarkadi and Rosenqvist (2001) performed field testing of a previously described group education programme for Type 2 diabetes. The intervention group in that study decreased their mean HbA1C significantly after 6 months. Trento et al. (2004) conducted a 5- year randomized controlled clinical trial of continuing systemic education delivered by group versus individual diabetes care in a hospital-based secondary care diabetes unit. Their study showed knowledge of diabetes and problem solving ability improved from year 1 with group care and worsened among control subjects. Quality of life improved from year 2 with group care but worsened with individual care. HbA1c level progressively increased over 5 years among control subjects but not group care patients, in whom BMI decreased and HDL cholesterol increased. The authors concluded that adults with Type 2 diabetes can acquire specific knowledge and develop conscious behaviors if exposed to educational procedures and settings tailored to their needs. These findings support the idea that an educational package and practical intervention can change the behaviour of people with a chronic illness such as diabtetes Type 2. This fits with the outcomes of this study which demonstrated that people can change their nutrition intakes and self-monitoring behaviour with the introduction of a specifically designed educational intervention.

However, other studies have reported different outcomes from the current study. For example, a study by Mazzuca et al. (1997) examined the effect of a community health nursing intervention on the health behaviours and health status of adults with insulin-treated diabetes. Their study

showed that the intervention significantly enhanced the self-report and self-care behaviours of blood glucose testing and complication management but found no differences between the groups in outcomes for dietary adherence, foot care, blood glucose levels and overall diabetes knowledge, metabolic control or functional health status. To summarize, most research showed diabetes education can improve blood glucose control, a similar finding to this study.

5.3 Reduced complication rates – Hypothesis 2

The impact of cardiovascular disease on mortality and morbidity in people with diabetes has been known for years. Approximately two-thirds of people with diabetes die from cardiovascular disease. Recently, data from the National Health and Nutrition Examination Survey (Gu et al. 1999) showed that over the past 30 years there was a 27% decline in age adjusted heart disease mortality in women without diabetes, but in women with diabetes, there was a 23% increase. In men without diabetes, there was a 36% decline compared with a 13% decline in men with diabetes (Brown et al. 1999). On a population basis, cardiovascular disease is the most costly complication of Type 2 diabetes. The American Heart Association (Grundy et al. 1999) has officially identified diabetes as a risk factor for coronary heart disease. Recent studies have provided greater understanding about the relationships between diabetes and cardiovascular disease, as well as evidence of the benefits of controlling blood lipids and blood pressure in people with diabetes. For example, the U.K. Prospective Diabetes Study (UKPDS) showed that the risk factors for coronary heart disease in Type 2 diabetes were, in order of importance, increased LDL cholesterol, decreased HDL cholesterol, hypertension, hyperglycemia, and smoking. Dyslipidemia also contributes to the risk of renal disease. Hypertension accelerates the rate of progression of diabetic renal disease. Control of blood pressure as well as glucose retards this progression. Lowering blood pressure in a subset of the UKPDS subjects to a mean of 144/82 mmHg reduced the risk for stroke, diabetes-related deaths, heart failure, microvascular disease, and retinopathy up to 56%. The DCCT and the UKPDS

demonstrated that intensive blood glucose control for patients with Type 1 and Type 2 diabetes significantly reduced the risk for retinopathy, nephropathy, and neuropathy (Clark et al. 2001).

In addition, the National Diabetes Education Program (2007) suggested the recommended therapy goals for the ABCs of diabetes: A1C (blood glucose) less than 7 percent; Blood Pressure less than 130/80 mmHg; and Cholesterol – LDL less than 100 mg/dl. People with diabetes do lower their cardiovascular disease (CVD) risk using a variety of successful management approaches including therapeutic lifestyle changes such as diet, weight management and increased physical activity, as well as drug therapy which is also available to help control CVD risk factors and prevent or treat the complications of diabetes. People with diabetes should participate with their health care team in treatment decisions, set individual lifestyle goals, receive adequate education, and actively manage their disease,. their blood glucose and blood pressure to reduce the risk for eye, kidney and nerve disease. Epidemiological analysis of the UKPDS data showed for each 10-mmHg decrease in mean systolic blood pressure, the relative risk for microvascular complications decreased by 13%, diabetes-related deaths by 15%, and myocardial infarction by 11% (National Diabetes Education Program 2007). Taylor et al. (2005) identified how cardiovascular risk reduction can decrease morbidity and mortality in patients with diabetes mellitus; however, they claim this is seldom optimally achieved with standard care. A report by the researchers outlined the rationale and preliminary results of a clinic model using a multidisciplinary team approach to improve cardiovascular risk management in patients with diabetes mellitus. The study assessed risk-factor management for glycemia, dyslipidemia, hypertension and lifestyle in a retrospective survey of patients followed for 1 year or longer, in comparison with cardiology practice patients in a separate clinic at the same institution. The results showed that intervention by a team including a cardiologist, endocrinologist, certified diabetes educator, dietician, cardiovascular

advanced practice nurses and an exercise physiologist resulted in a high percentage of patients reaching and maintaining National Cholesterol Education Program goals for secondary prevention of coronary artery disease compared with standard care. The multidisciplinary approach resulted in a significant decrease in HbA1c compared with standard therapy and there was a trend toward a significant increase in high-density lipoprotein. The researchers concluded that multidisciplinary team care improves risk-factor modification primarily by improving glycemia and dyslipidemia. They propose that this model may be useful for enhancing the multiple risk-factor modifications needed to reduce cardiovascular morbidity in patients with diabetes mellitus and metabolic syndrome (Taylor et al. 2005)

The second hypothesis of the present study was that a specially designed health care education package decreased the subject's diabetic complication over a 6 month period. Table 4.35 identifies the markers for complications: Creatinine (0.6 – 1.5), urine analysis (protein and glucose both 0), microalbumin (all normal at baseline < 30), Cholesterol (130 – 225), Triglyceride (50 – 130), blood pressure (above 160 to 95), and cataract or retinopathy. Number of markers for complications can range from 0 to 7. At baseline: range of number of markers for complications 0-5; median number 1, IQR = [0, 2]. Control group (median number 1; IQR = [1, 2]) had significantly more positive markers for complications at baseline compared to intervention group (median number 0; IQR = [0, 1]; p = 0.010). At baseline, 42.0% of the intervention compared to 82.1% of control group had positive markers for complications (p=0.003). At 6 months follow-up: range of number of complications 0-4; median number 1, IQR = [0, 2]Control group (median number 2; IQR = [1, 2]) had significantly more positive markers for complications at 6 months follow-up compared to intervention group (median number 0; IQR = [0, 1]; p = 0.002). At 6 months follow up, 48.4% of the intervention compared to 87.0% of control group had positive markers for complications (p=0.006).

Although the present study did not reveal a decrease of diabetic complications for the study participants in the intervention group, the analysis showed that participants in the intervention group developed significantly less new complications when compared to the control group.

The finding of the present study was consistent with numerous previous studies such as Gagliardino and Etchegoyen (2001) who implemented an educational program in 10 Latin American countries to evaluate its effect on the clinical, biochemical, and therapeutic aspects and the economic cost of diabetes. Their results demonstrated that education of individuals with Type 2 diabetes can be both cost-effective and cost beneficial. They explained that even after discounting the cost of self-monitoring urine glucose levels, the decrease in drug intake represents a mean savings of 34% in pharmacotherapy. This decrease, the researchers explained, along with the corresponding reduction in the lifetime risk for developing chronic complications, could result in a diminution of the socioeconomic burden and an improvement in quality of life for individuals with diabetes. They suggested that an educational approach promoting healthy lifestyle habits and patient empowerment was an effective strategy with the potential to decrease the development of complications related to diabetes as well as the socioeconomic costs of the disease (Gagliardino & Etchegoyen 2001).

A study by Huang (2003) enrolled 506 patients of Type 2 diabetes in the experiment group and 93 Type 2 diabetes patients as control group in Taiwan during 1998. The results from that study also support the premise that lifestyle change resulting from a diabetic patients care (CPDPC) education project can effectively facilitate diabetes control and hence reduce the risk of diabetes complications. Other studies have also shown that diabetes education programmes have significantly decreased diabetes complications. Balamurugan et al. (2006) pointed out that diabetes prevalence has reached epidemic proportions and that diabetes self-management

education (DSME) is important to improve preventive care practices and clinical outcomes. DSME programs in that study were delivered by a registered nurse and a dietitian who provided 10 to 13 hours of education to each program participant. Their results showed the number of participants in the DSME programs increased 138% in 1 year, from 308 in February 2003 to 734 in March 2004. Preventive care practices improved daily blood glucose monitoring increased from 56% to 67% of participants, and daily foot examinations increased from 63% to 84% of participants. The glycosylated hemoglobin levels of the participants who completed the program decreased by an average of 0.5 units (Balamurugan et al. 2006).

The findings of the current study further validate the theory that exposure to diabetes education relates to decrease in the diabetic complication rate. Chen (2005) reported how a study undertaken to empower patient's self-skill on foot care decreased the lower limb amputation rate. Self-efficacy has been shown to be an important predictive variable in initiating and continuing management behaviors such as blood glucose control, appropriate diet and exercise. However, there is limited research to date on the foot care knowledge, practice and self-efficacy in Type 2 diabetes in Taiwan, especially for Aboriginal people. The researchers evaluated an educational program on foot-care knowledge, self-efficacy and practice for Truku aboriginal people with Type 2 diabetes in the mountain Village of Hualien County, Taiwan. The intervention was studied using a nonrandom two-group design including the pre and post testing of fifty-one people with diabetes for experimental and fifty-nine with diabetes for the control group. The research subjects were aged from 35 to 81 years old. The experimental group received a foot care program which included individual foot care education incorporating a monofilament test, tuning fork check, palpate pulses, skin appearance, nail, socks and footwear and structural deformity, and group education intervention. The effect of difference on foot-care knowledge, self-efficacy and self-care practice between the experimental and control groups was measured after a one month intervention. The results indicated that a foot-care educational program was

effective in promoting the knowledge, self-efficacy and behaviors of self-care for aboriginal people with diabetes. The researchers said they would provide the results of the study to professional health-providers for policy making and modifying clinical education of Type 2 diabetes in tribes of Hualien County, Taiwan (Chen 2005).

5.4 Improve behaviour with respect to exercise, healthy diet choices and better blood glucose management and therefore improve quality of life – Secondary hypothesis

Literature has shown that regular exercise, healthy diet choices and better blood glucose management contribute significantly to positive quality of life in individuals experiencing a variety of chronic illnesses such as diabetes mellitus. Studies of clinical and educational interventions suggest that improved patients' health status and perceived ability to control their disease results in improved quality of life. Cooper et al. (2003) pointed out the interdependence of diabetes management strategies which centre around three key elements: (1) Education and support for self-management (including reduction of lifestyle risk factors). (2) Effective drug treatment strategies for maintaining normal blood glucose and lipid levels, and normal blood pressure. (3) Effective surveillance for early detection and treatment of complications.

Further, a study by Liao et al. (2004) demonstrated that blood glucose testing is crucial to diabetes control, and it is effective in reducing the risk of complications and improving life quality. Unfortunately, both elderly patients and their caregivers find it difficult to monitor glucose levels long term. The developed system described in the study prompts diabetics to measure their blood glucose regularly at home, and provides remote care persons with complete information about the patient's measurement. This aids in the improvement in diabetes control, thereby increasing the social activities and life quality of diabetics. Visser and Snoek (2004) identified how education and counseling play a central role in the management of chronic diseases. In diabetes, patient

education and counseling are viewed as cornerstones of diabetes management, because self-management can contribute significantly to improvement of glycaemic control, quality of life, and reduction of long-term implications. A similar study (Araki 2006) showed that diabetes education in the elderly improves metabolic control and helps to maintain quality of life. They claimed that a simple dietary education program, including point-to-point advice, may be effective in elderly individuals. Further, they explained that resistance exercise as well as aerobic exercise should be recommended for prevention of atherosclerotic disease, osteoporosis, sarcopenia, and depression as well as for glycemic control. Self-monitoring blood glucose is an important measure to cope with hypoglycemia or sick days. In case of unstable dietary intake, sliding rules of insulin dose should be instructed to patients and their families. Psychological support is essential to patients and their caregivers who support diabetic patients having dementia, depression, and disabilities. Other studies have also supported the hypothesis that self-management behaviours improve quality of life (Glasgow et al. 1997; Delamater 2006). Delmater (2006) explained that diabetes is a challenging disease to manage successfully. The researcher explained that although the care regimen is complex, patients with good diabetes self-care behaviors can attain excellent glycemic control. However, many patients do not achieve good glycemic control and continue to suffer health problems as a result. Wang et al. (2007) describe how Type 2 diabetes and its related health issues have seriously threatened the health of Taiwanese people, especially the middle-aged and elderly. To control Type 2 diabetes, both medical care and lifestyle changes are needed. Heisler et al.(2007), in a study that included a national cross-sectional survey among 1588 older community-dwelling adults with diabetes, concluded that among these older adults, both their diabetes providers' provision of information and efforts to actively involve them in treatment decision-making were associated with better overall diabetes self-management. Lin et al. (2006) also pointed to self-care as a cornerstone of diabetes management and argued that the daily practice of healthy nutrition and physical activity can slow disease progression. Further, they claim that adherence to medical regimens for diabetes

can lessen the disease burden and reduce the morbidity and mortality associated with diabetic complications (Lin et al. 2006).

According to Pender (2005) the HPM depicts the multidimensional nature of individuals interacting with their environments as they pursue health. Health promotion is directed toward increasing well-being and self-actualization of an individual or group (Newton et al. 2004). Quality of life has been used interchangeably with such terms as well-being, psychological well - being, happiness, life satisfaction, positive and negative affect, and the good life (Cheng 1988; Evans 1994; George 1992, cited in Evans 2008). The positive findings in the current study are further evidence to establish the validity of the Health Promotion Model (HPM). In this study, participants who accepted a health care package and perceived better diabetes self-care knowledge, toward to positive self-care attitude and behaviour such as increase in exercise, healthy diet choices, take medication by doctor's guideline and blood glucose monitoring. However, the finding of the current study did not show that the effect on overall quality of life on diabetes patients was positive and consistent across regular exercise, healthy diet choices and better blood glucose management. Similarly, Stuifbergen (2006) proposed that health-promoting behaviors may mediate the negative effects of impairment on the quality of life for persons with chronic disabling conditions. The study was conducted to determine if an explanatory model of health promotion and quality of life developed and refined in earlier studies had similar findings across persons with multiple sclerosis (MS) and post-polio syndrome (PPS). This model proposes that quality of life among persons with chronic disabling conditions is the result of the direct and indirect influences of contextual, attitudinal and behavioral factors. A sample of 786 persons with MS and a sample of 1603 persons with PPS completed an instrument battery including measures of functional limitations, barriers to health-promoting behaviors, resources, self-efficacy, acceptance, health promoting behaviors and perceived quality of life. This study supports the assumption that commonalities may exist in the strategies persons with various conditions use to

promote their health and quality of life (Stuifbergen 2006). Lee et al. (2006) pointed out that as individuals live longer, health promotion behaviors become even more important, particularly with regard to maintaining functional independence and improving quality of life (QoL). Their study was to explore the relationship between health promotion behaviors and QoL in Korean elderly living in the community. Their study, a descriptive-correlational study to explore the relationship between health promotion behaviors and QoL among the community-dwelling elderly in Korea, used a convenience sample of 2000 community residents over 65 years old and cognitively intact. A total of 1920 data sets were included in the analyses. The researchers concluded that nurses can enhance the QoL in elderly persons by facilitating health promotion behaviors through formal nursing interventions which will maintain and increase a healthy and active life. Stuifbergen et al. (2000) study also showed that interventions to enhance social support, decrease barriers, and increase specific self-efficacy for health behaviors would result in improved health-promoting behaviors and quality of life for elderly people with serious health problems.

Comparisons between the experimental group and control group of this study at three and six months of follow-up, with respect to the Health Perception Questionnaire and the WHO quality of life questionnaire (Taiwanese version), showed no significant differences (see tables 4.18, 4.19, 4.24, 4.25).

Why does the experimental group who had improved diabetes knowledge, attitudes and behaviours have no significantly different quality of life in comparison to the control group? Two reasons could be formulated to explain why the experimental group had no significant change in their overall quality of life although they obtained better scores in self care and self care activities. One possible reason could be that one may need a longer follow-up time to see the required change in quality of life. In this study, participant's quality of life was assessed after three and six months which might not have been sufficient to show a significant difference.

Another possible explanation could be that despite improvements in awareness and self-care, complications related to diabetes increased. These complications might have an important impact of quality of life. In addition, quality of life is such a subjective experience and therefore extremely individual. Some participants showed a lower score of quality of life and a high score regarding self-care recommendations and activities. Cella (1994) said that quality of life is understood to be both subjective and multidimensional. Because it is subjective, it is best measured from the patient's perspective. Because it is multidimensional, its measurement requires the investigator to inquire about a range of areas of patient's life, including physical well-being, functional ability, emotional well-being, and social well-being. Several studies may be needed to provide a better understanding on how the assumed participants' feeling could be a problem to measure quality of life. Hicks (1999) said diabetes education should increase knowledge, enhance skills and attitudes, improve quality of life and prevent complications associated with the disease. Similar to this finding, a study by Verma et al. (2001) used the Health Related Quality of Life (HRQOL) scale to assess 250 patients with inactive inflammatory bowel disease (IBD). Data analysis showed the level of disease related knowledge appears to be better in patients with chronic diseases, though that does not seem to affect quality of life. The Hänninen et al. (2000) study also showed a similar result. They studied 381 subjects with Type 2 diabetes aged under 65 years and 260 (68%) participated in the study. Data analysis pointed out that health-related quality of life (HRQOL) was associated with regular clinical review (check-up at least twice a year) and continuity of care (the same GP for at least 2 years), education by a diabetes nurse, and satisfaction with diabetes education. No associations were found however between the HRQOL dimensions and home glucose monitoring, participation in educational courses, or satisfaction with care.

5.5 Different disease perceptions exist between Aboriginal and non-Aboriginal Taiwanese elderly with Type 2 diabetes – secondary hypothesis.

Table 4.5 provides the comparisons of demographic characteristics between Aboriginal and non-Aboriginal participants at baseline. For the majority of demographic characteristics, Aboriginal and non-Aboriginal participants were not significantly different at baseline. However, the percentages of Aboriginal participants with known diabetes complications and with other chronic diseases were higher than in the non-Aboriginal participants. Comparing socio-demographic characteristics (RAND social health battery) between Aboriginal and non-Aboriginal participants at baseline (see Table 4.6) revealed few significant differences between Aboriginal and non-Aboriginal participants. Data showed that non-Aboriginal participants said they have more friends to support their life than Aboriginal participants, and also said they get better along with other people these days when compared to Aboriginal participants. In addition, non-Aboriginal participants answered they had attended a religious service during the past month, more than for Aboriginal participants, and they had belonged to voluntary groups more than for Aboriginal participants. There were also few statistically significant differences between Aborigines and non-Aborigines with respect to lifestyle factors (Table 4.7) except non-Aboriginal participants were more likely to eat more fruit and vegetables than Aboriginal participants.

Based on these results, it was concluded that in Taiwan today, older adults aged over 65 years receive information and transport more conveniently than in the past. Although most of the older Aboriginal participants lived in the mountains or in remote areas, through TV, radio, or public health centres they receive information as quickly as non-Aboriginal Taiwanese people. Chang (2005) pointed out that Taiwan's government has introduced changes so that underserved people, for example the poor, rural and indigenous patients, receive appropriate health care. Scholarships are offered to indigenous medical students who agree to practice in their hometowns. Other changes include health promotion schemes and educator programs, and

restructuring emergency networks. Medical teams now visit remote areas and technology is used to link rural clinics with academic medical centres and universities (Chang 2005). Another study (Liu & Kinsey 2005) also reported that in order to promote medical access for all Taiwanese citizens, the Taiwanese government carried out a compulsory national health insurance (NHI) scheme. People pay using a single-payer fee scheme is reimbursed. All citizens participate in the NHI scheme irrespective of their age, sex, family income, and health status. This compulsory system prevents flawed selection which can happen under other health insurance arrangements. In the end, the great majority (99%) of the civilians belong to this scheme. In 1999 most hospitals and clinics (94%) were contracted with the NHI Bureau (Liu & Kinsey 2005). In addition, in Taiwan, diabetes is the 4th leading cause of death. In order to prevent diabetic complications leading to patient death, the Department of Health (DOH) decided to construct diabetes shared care network, especially in remote areas (http:/member.giga.net.tw/tbemcom/06/6-5p1/tbemw6-5-2-160.htm).

However, most likely due to mountain isolation, older Aborigines spent less time to attend religious services and were less likely to belong to any voluntary groups than non-Aborigines. In addition, Aborigines were more likely to eat wild animals to celebrate cultural events and ceremonies. The results of the study suggest that different cultural and lifestyles factors of Aboriginal and non-Aboriginal older adults with Type 2 diabetes today have only little affect on their disease perception.

5.6 Implications

Theoretical implications

The analysis of quantitative data revealed that the experimental group changed their diabetes self-care knowledge, attitudes and behaviours and this further improved their blood testing. In addition, the modifying factors, including characteristics of patient and community resource,

social support were not associated with patients' cognitive-perceptual factors. The Taiwanese health care system has high usage of outpatient service, which accounts for 68% of total health expenditures and many medical resources in Taiwan (Chang, 2005). In Taiwan, hospitals are both public and private institutions. Over 60% of hospitals are private. The hospitals have large outpatient departments treating over 5000 patients daily. All hospitals and 90% of clinics contract with NHI. In Taiwan, the NHI used a fee for service system to pay clinics and hospitals. The schedule is negotiated yearly between government and providers; the NHI program has reformed its payment system since 1995, paying for treatment of diseases such as breast cancer, asthma and diabetes (Chang, 2005). This indicates that although participants have a lower income, they get the same health care services and receive diabetes information from public health centres, private clinics and hospitals. The diabetes self-care information and services also affect the patients' disease perspectives.

Implications for Nursing Curriculum

A health care package is a major factor influencing the outcome of education. The results of this study support the contention that an ecological approach to curriculum development about diabetes education should be implemented. A health care package should be featured as a setting to produce diabetes knowledge, attitudes and self-care behaviours and quality of life rather than a teaching method only to consume diabetes education.

The finding of current analysis confirmed the major attributes of diabetes education outcome which consisted of participants' characteristics, social support, community resources and diabetes perceive. The integrative approach in the diabetes education curriculum should be emphasized to help student define a proper concept of health for the population with Type 2 diabetes mellitus.

Implications for Nursing Practice

A health care package not only affects diabetes patients' self-care knowledge, attitudes and behaviours. It also improves the medical record such as glycemic control of patients with Type 2 diabetes mellitus. A health care package should be included in the community health promotion plan when a patient with Type 2 diabetes mellitus is treated. The modification of diabetes education should include nursing practice, experience sharing or role playing to emphases older adults' memory. For example, if an education provider, through nursing practice, teaches diabetic patients how to wash, dry gaps between toes and how to massage foot muscle, the effects are better than teaching by lecture alone. In addition, considering older adults' learning ability, the education provider should speak slowly using simple sentences within a short time-frame to decrease the barriers to learning. On the other hand, it is difficult for older patients with diabetes to adhere to diabetes self care. Education providers can, through peer group experience, assist older adults to learn diabetes knowledge, attitudes and self-care behaviours. For example, after implementing an education programme, the education provider can arrange for several patients with diabetes to share diabetes self-care experiences as a way to emphasise older adults' image. Most older adults aged over 65 years have difficulties changing their life style, such as eating and exercise, hence education providers can arrange family gatherings around activities other than eating and exercise which would help the diabetes regimen to be more easily integrated into ordinary daily life. In Taiwan, many older adults live together with their sons and daughters-in-law. Thus the elderly with diabetes in Taiwan would not be required by their environment to be involved actively in the purchase and preparation of food. By encouraging families to adopt healthy eating practices, the sense of deviance from other families could be reduced, in turn reducing the emotional distress caused by food longing or agitation resulting from family supervision. Education providers should tell families the life style of the entire family would benefit not only the member with diabetes, but also by reducing

and delaying his/her risk of developing the diasease as well as minimising the risk of cardiovascular disease for the whole family (Dai 1995).

However, Wu (2004) found different results in regards to health practice. The researcher explored how physical and psychosocial factors influenced the practice of health-promoting behaviors among Chinese elderly patients with Type 2 diabetes. Individual structured interviews were conducted with 191 elderly Chinese attending an outpatient clinic in Hong Kong. Results showed that demographic and illness characteristics were unrelated to health practices. Participants were more likely to engage in health-promoting behaviors when they were physically well, valued their health, were confident of practicing the behaviors and viewed their illness as controllable by both doctors and themselves.

For the education provider, the level of diabetes education and the way teaching methods are conducted should be assessed before and during the process of teaching. The findings of the current study showed that a health care package was associated with positive effects on diabetes knowledge, attitudes, self care behaviours and medical characteristics in the experimental group. However, the intervention did not show significant changes in the diabetes participants' quality of life. A longer follow-up time might be required for longer-term benefits to become evident.

Implications for Future Research

1. The findings of this study show that a health care package designed by the researcher is an important variable on diabetes knowledge, attitudes and self care behaviours in case of older Taiwanese with Type 2 diabetes mellitus. It is important as it indirectly affects patients' medical records such as blood glucose, nephropathy and lipid profile. However, the package failed to decrease the risk of diabetes complications. It was only able to show a reduced rate of increase in the intervention group.

2. Further examination of the relationship between diabetes knowledge, attitudes, self care behaviours, medical record and quality of life is needed. Diabetes knowledge, attitudes, self care behaviours, medical record and quality of life are the important issues in the care of the diabetes older patients. Whether the Patient Education Model could be applied to further study of a health care package and diabetes self care management outcomes should be confirmed with empirical testing.
3. A further study using the Patient Education Model of analysis would provide valuable insight into the understanding of how a patient's characteristic, social support and community resources affect patient's disease perception and patient's disease perception of self care outcomes. For example, inconvenient transport affect patients in terms of accessing health care information. Also, patients living alone lack support systems and the means to get health resources and the length of time a person has had the disease has also been found to impact how they perceive the disease. The disease perception is thought to be directly associated to patient's self care management and indirectly affects disease complications and quality of life. The knowledge from this type of research will help researchers to build a better educational theory, and increase mobilization of educational resources for promoting the patient learning.
4. In this current study, the comparison of the different cultures and lifestyles of Taiwanese Aborigines and non-Aborigines showed that there were no significant differences between their diabetes perceptions. Further ethnic studies would be worthwhile.

CHAPTER 6: STRENGTHS, LIMITATIONS AND CONCLUSION

6.1 Strengths of the Current Study

The strengths of this study have been identified as follows:

1. Krichbaum et al. (2003) study reviewed the existing empirical evidence about factors contributing to effective diabetes self-management as indicated by healthy outcomes in persons with the disease. They identified education sessions as needing to involve few lectures and more practical, interaction based exercises that focus on developing specific skill. The study reported here implemented those principles, where the main advantage of the study was the use of a specially designed health care package developed with a particular cohort in mind. This education programme was designed in relation to Taiwanese older adults' learning ability, cognitive, ethic and life style. It used several different teaching methods such as nursing practice, lecture, experience sharing, replacing typical diabetes education programmes in teaching older diabetes patients. Using face to face interviews to collect the questionnaire data was useful as was combining this information with the participants' medical records to collect a complete understanding of their condition. The analysis of quantitative data showed that a health care package was statistically significant in bringing about change to the participants' levels of diabetes knowledge, attitudes, and self care behaviour. In addition, the medical records indicated an overall improvement in the participants' condition.
2. The measurement of the patient's characteristics used in the current study was culturally and ethnically specific. The other measure such as Summary of Diabetes Self-Care Activities (SDSCA) and WHOQOL (Taiwan version) developed in Taiwan were revised and tested through the earlier pilot study. It is well known that the usefulness of the data received from conducting measurements is linked directly to the effectiveness of the tools. One of the key determinants of the effectiveness of tools is their ethnic appropriateness. This study utilized

an earlier adaptation of the tool that was modified specifically for use with a Taiwanese population.

3. The health promotion programmes have been considered as the first alternative for reducing patient disease complications and improving quality of life. Previous studies conducted in Western countries have focused on the health promotion programmes to improve patient's quality of life. However, although the Taiwanese government arranges many health promotion programmes for delivery in local health centres, they tend to cover areas such as how to prevent hypertension, diabetes mellitus and cancer. The health promotion programmes which affects the adaptation to chronic illness of those less disabled elderly and their ability to live a better life is an important but a less studied issue. The current study was a specifically designed health care package to effectively communicate and integrate different culture and lifestyle education materials in diabetes education for varied Taiwanese elderly. It is suggested that the NHI should be encouraged to adopt this education programme and make it available across Taiwan. The focus of the current study on different ethnic and cultural lifestyles of Taiwanese elderly has the potential for further adaptation and could provide valuable knowledge to the wider field of gerontology.

6.2 Limitations of the study

The limitations of this study have been identified as follows:

1. It was not possible to select diabetes patients randomly into the project and it was additionally not possible to randomize patients on the individual level into intervention and control groups. Therefore, cluster randomization was conducted with the clusters being the hospitals and other primary care facilities that the patients attended. Baseline comparisons showed however, that cluster randomization worked mostly; all analysis was adjusted for the cluster sampling strategy and analyses of main hypotheses were conducted using multivariate models to allow for adjustment of confounders. However, because randomization was not

conducted on the individual level frequencies of complications were very different between intervention and control group. In addition, data were collected according to participant willingness. However, considering time and budget limitation, this research could not collect samples from all areas of Taiwan. Therefore, as can be seen, with some due caution, results can be generalized for all of the diabetes population from middle Taiwan to Northern Taiwan.

2. In the Aboriginal group section, because of time and budget limitation, most Aborigines were selected from the Amis and Atayal group who are the largest and second largest group of Taiwanese Aborigines. Hence the research did not include all Aboriginal groups.
3. Because of time and budget limitations, the diabetes education was provided only three times for each experimental participant. When the participants finished the pre-test, they were asked to attend a one hour diabetes education session every week for three weeks. After the pre-test at 3 months, they were given the first post test, and after the pre-test at 6 months they were given the second post test. However, as all participants were older people and needed more time to practice the diabetes self care, such as foot care, diabetes exercise, and diabetes diet preparation, a different result may have resulted if there had been time and budget to conduct additional educational sessions.
4. Data were collected from both patient self-reported questionnaires and reviews of medical records. The former might have some limitations related to human factors such as memory, interpretation, and social desirability; the latter might be limited due to incomplete records.
5. Participant levels of HbA1C, nephropathy assessment such as serum creatinine, urine acid, urine protein and urine glucose; lipid profile such as cholesterol, LDL-C, HDL-C and triglyceride were collected on the basis of the last test to be administered prior to responding to the questionnaires. However, given the current Taiwanese government health budget, not all physicians regularly prescribe tests of the HbA1C, nephropathy assessment and lipid profile level for their patients. Thus, some participants had their HbA1C checked and paid the

fee for the service themselves as well as for a three months follow-up, but nephropathy assessment and lipid profile levels were not followed up three months later.

6. The data were collected from the older adults' perspective only. It may be useful to develop and test a similar educational package with other age groups.

7. It was very difficult to investigate participants' self-care behaviours in their daily life. Researchers used the self-care activity questionnaire and medical records to adjust their self-care activity evaluations but it was suggested that Summary of Diabetes Self-Care Activities (SDACA) should only be used with the individuals who have maintained contact with their caregivers. In addition, the researchers also found that most of the older adults had difficulty answering or refused to answer questions about their sexual experience in Quality of Life (WHOQOL-Brief)(missing 45 data). This item also affected total score. This was unfortunate as the study was reliant on self-reporting by participants. However, self-reporting is a known limitation of research studies and the problems in this study are consistent with the problems identified by many other researchers.

8. Because quality of life is a subjective feeling, the patient reported finding of the current study did not show that the effect on overall quality of life on diabetes patients was positive and consistent across regular exercise, healthy diet choices and better blood glucose management. An increased sample size and longer follow up might be required for testing quality of life in future studies.

9. Because of time and budget limitations, this study did not test Aboriginal Taiwanese persons living in Taiwan's main city. It is possible that different living environments are an important variable factor. Educators need more time to test this population.

6.3 Conclusion of the study

The primary purpose of this study was to test an education intervention designed to enhance participants' diabetes self care knowledge, improve attitudes and behaviours, and improve

biomedical test results and quality of life in Taiwanese elderly with Type 2 diabetes. The secondary purpose of this study was to compare the different ethnic groups (inclusive of different cultures and lifestyles) that affect their diabetes perception.

This study had an experimental design with a cluster randomized sample (N=500, included experimental group 241 and control group 259; after three and six months followed-up: N= 485 experimental group 235 and control group 250) of Taiwanese elderly with Type 2 diabetes. The quantitative data included face to face interviews and followed up by telephone were collected from 500 participants. Five research questionnaires were used in this study. The first questionnaire was the Diabetes Personal Data Sheet which includes patient's demographic data and health status. The researcher modified the Chinese version after receiving permission from Chang et al. (2003). The demographic data collected included age, gender, education, ethnicity, occupation, insurance, and marital status and/or de-facto. The health status included length of time since diagnosed with diabetes, self-known diabetes co-morbidities and non-diabetes co-morbidities, pharmacological status, recent blood glucose. The secondary questionnaire was the Rand Social Health Battery and Social Services. The Rand Social Health Battery questionnaire which includes an 11 item self-report scale that provides for social resources and social interaction. The Social Services Interview questionnaire was adapted from the "Structured Guide" (Ervin 2004). The questions focused on the family's experiences of using services from various agencies and social services. The third questionnaire was The Health Perceptions Questionnaire (HPQ) (Ware 1976) which includes 33 items. It is a self-report instrument that records perceptions of past, present, and future health, resistance to illness, and attitude toward sickness. The fourth questionnaire was the Summary of Diabetes Self-Care Activities (SDACA). The SDSCA scale consists of 11 items and 14 additional questions including diet, exercise, self-monitoring of blood glucose, foot care and smoking termination. The scale was calculated for the diet and exercise regimen area using the mean number of days per week on a scale of 0 to 7 (Anderson & Svardsudd 1995; Wen et al. 2004). The last

questionnaire was Quality of Life (WHOQOL-Brief-TAIWAN) which contains four domains, and 26 facets including physical, psychological health, social relationship, and environment. The other items were used to test overall perceptions of quality of life and general health. A five-point Likert scale was used in this questionnaire. The higher the score obtained means the higher the quality of life perceived by the respondent. The five questionnaires of each item in this survey were examined independently by a panel of expert professionals who specialize in diabetes mellitus during the pilot study.

Four research hypotheses were investigated in this study. For the first hypotheses: a specially designed health care package will have a significant effect on patient with Type 2 diabetes mellitus. The findings showed that a health care package had a strong association with well controlled blood glucose levels and increased levels from about 20% to 40%. Participants who accepted a specially designed health care package tended to manage their self-care activities well. For the secondary hypotheses: A health care package will encourage lifestyle change for Taiwanese Aboriginal and non-Aboriginal older adults with Type 2 diabetes and will therefore decrease their diabetic complications. However, complication rates increased in both the experimental and the control group, however to a lesser degree in the intervention group. For the third hypotheses: a health care package will result in increase in exercise, healthy diet choices and better blood glucose management and will therefore lead to a better overall quality of life. For example, the Hänninen (2009) study concluded that a permanent physician–patient relationship may improve health-related quality of life (HRQOL) in subjects with Type 2 diabetes and McMurray et al. (2002) reported that a program of intensive diabetes education and care management in a dialysis unit was effective in providing significant improvements in patient outcomes, glycemic control, and better quality of life in patients with diabetes mellitus (McMurray et al. 2002). The findings in this stuidy indicate the experimental group had a higher score in increase in exercise, healthy diet choices and better blood glucose data but did not show

that the effect of overall quality of life was increased. For the last hypotheses: different cultural and lifestyles of Aboriginal and non-Aboriginal older adults with Type 2 diabetes will affect their disease perception. The findings reported the majority of demographic characteristics of Aboriginal and non-Aboriginal elderly were not significantly different. However, Aboriginal participants with known diabetes complications also experienced other chronic diseases at a higher rate than the non-Aboriginal participants. In addition, non-Aboriginal participants had more friends to support their life, reported getting along with other people better these days, and were more likely to have attended a religious service, or belonged to a voluntary groups more often than Aboriginal participants during past month. They were also more likely to eat more fruit and vegetables than Aborigines which may be linked to their disease perceptions.

The quantitative data provided rich information to help interpret the findings. Quantitative data revealed that researchers and educators need to take into account the different ethnic, cultural and lifestyle issues of Taiwanese elderly with Type 2 diabetes mellitus when planning to design a special health care package to affect diabetes patients' knowledge, attitudes and behaviours and improving medical outcomes. However, a special health care package did not contribute to an increase in participants' perceived quality of life. Further investigation is therefore required to confirm the effects of educational packages on adult participants' quality of life.

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APPENDICES

APPENDIX A

Cover Letter for Questionnaire (Pilot)

JAMES COOK UNIVERSITY
Townsville Campus
Townsville QLD 4811 AUSTRALIA
Web: www.jcu.edu.au

You are invited to participate in a study "A comparative study of the effects on health care package on knowledge, attitudes and self-care behaviours of older Taiwanese Aboriginal and non-Aboriginal adults with Type 2 diabetes in Taiwan".

My name is Chao, Ying-Hua and I am a doctoral student in Nursing at the James Cook University, Australia. This project is the pilot study of my dissertation research. I hope to learn the experience of diabetes care you received. If you participate, you will be one of the approximately 40 diabetes patients in the study.

If you decide to participate, I will ask you to complete a questionnaire. The completion of the questionnaire will take about 15 minutes. There is no risk in answering these questionnaires. Great care will be used to maintain confidentiality. This study will be a good opportunity for you to contribute your information about diabetes to the health care system as the reference for providing better diabetes care in the future.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Your responses will not be linked to your name in any written or verbal report of this research project. Your decision to participate or to decide not to participate will not affect the health services you will receive or your relationship with your physician, health care providers, local public health stations of your living communities.

If you have any questions about the study or the q s, please ask me. If you have an v contact me at (Taipei, Taiwan) or via e-mail If you have any questions about your rights as a research participant, you may keep a copy of the cover letter for your records and make contact with my supervisor at the University (see details below).

You are making a decision whether or not to participate. Your actions of answering the questionnaires will indicate that you have read the information provided above and have decided to participate in the study. If you later decide that you do not want to participate in the study, simply tell me. You may discontinue your participation in this study at any time. Thank you very much.

Sincerely

Chao, Ying-Hua
Doctoral Candidate
JCU School of Nursing

Supervisor
Professor Kim Usher
Telephone: +617 47814261
Email: kim.usher@jcu.edu.au

APPENDIX B

Cover Letter for Questionnaire (Pilot) - Chinese Version

封面說明

您好,我很榮幸能邀請您參與這個問卷的研究計劃，我的博士論文主題是要「探討一個衛生教育對臺灣老年人糖尿病病患知識,態度及自我照顧行為的影響」。這個是我的博士論文計劃，我的名字叫做趙櫻花，現就讀澳洲詹姆士庫克大學護理博士班，這個計劃是為我的博士論文做準備，我希望了解您對糖尿病照護服務之看法以及您個人的糖尿病照顧的經驗。您會被邀請參與這個研究計劃是因為您在衛生所就醫。

如果您決定參與，我會請您花大約30分鐘填寫問卷，填寫問卷沒有任何的危險性，只是需要花您一點時間，您的名字將不會和您所填答的內容相連結，這個研究會幫助您比較了解您在糖尿病的自我照顧，也是一個您能對較高品質的糖尿病照護有所貢獻的機會。問卷中如果有任何讓您覺得不方便回答的問題，您可以不必回答每一個問題。

任何您所提供會被認出您個人的訊息都將保留隱私權，除非徵得您的同意，否則不會被透漏，您所填答的內容在發表口頭或書面研究結果的時候也將不會列出您的姓名，您決定參加與否不會影響任何醫療照護機構對您的服務，也不會影響您和衛生所醫護人員或澳洲詹姆士庫克大學的關係。

如果您有任何有關這個研究的問題，可以隨時問我，我的聯絡電話是
或用電子郵件和我聯繫，我的信箱是 yinghua.chao@jcu.edu.au 或
；您也可以用英文直接和我的指導教授Usher博士聯繫，她的電子郵件信箱是 KimUsher@jcu.edu.au。

您可以保留這張說明做為參考。

您現在正在決定是否參加此研究，若您已經了解它的重要性並且同意參加,請在後面簽名，如果您決定不想繼續參加，請讓我知道，您可以隨時中斷參與，再次感謝。

澳洲詹姆式庫克大學護理系

博士候選人 趙櫻花 敬上

APPENDIX C

Invitation Letter
(JCU Letterhead)

JAMES COOK UNIVERSITY
Townsville Campus
Townsville QLD 4811 AUSTRALIA
Web: www.jcu.edu.au

My name is Chao, Ying-Hua, a doctoral student in James Cook University, Australia. I am pleased to invite you to participate in my dissertation study. I am an experienced lecturer in diabetes care. My study is assessing the Diabetes Education for Taiwanese Aboriginal and non-Aboriginal older adults. If you participate in the study, the only thing you will do is to complete some questionnaires. If you prefer, I can ask you questions in an interview. The results of the study will provide improvements in the quality of diabetes care. I will contact you by phone if you agree to be contacted. If you are willing to be contacted, please check the following box and return this letter to me. If you do not wish to be contacted, do not return this letter. Thank you very much.

Sincerely
Chao, Ying-Hua

……..
Postcard

Yes, I am willing to participate in the study.
Phone number: _____
Other (Please indicate how she can contact you.):
Name: _____
Please mail to: Chao,Ying-Hua
Address:

APPENDIX D

Invitation Letter
Chinese Version

邀請函

_____先生/女士，您好：

這封信是邀請您參加趙櫻花女士 (澳洲詹姆士庫克大學護理博士班學生)的博士論文研究計劃，我的論文研究是藉由衛生教育的方案來增進糖尿病患自我照顧的知識，態度即能力,進而改善生活品質的研究。希望您能提供寶貴的經驗，如果您參與這個計畫，唯一需要您幫忙的是花三十到四十五分鐘填寫問卷，如果您不方便閱讀問卷，我本人或我的助理會透過面對面或電話訪問來協助您完成，研究的結果將提供醫護人員未來改善糖尿病照護品質的參考，如果您同意，我將會打電話和您聯絡，如果您同意參加，則請勾選下列回函並立即寄回以下地址，如果您不同意，就不需要寄回此回函，感恩您。敬祝身心健康愉快！

趙櫻花敬上

回函請寄

回函

□ 我同意參加，請和我聯絡

姓名：_____

電話：_____

或其他聯絡方式：_____

APPENDIX E

Consent Form for Study

Consent Form for Study of a comparative study of the effects of health carepackage on knowledge, attitudes and self-care behaviours of older Taiwanese Aboriginal and non-Aboriginal adults with Type 2 diabetes in Taiwan

My name is Chao, Ying-Hua and I am a doctoral student in Nursing at James Cook University, Australia. I want to invite you to participate in my study "A comparative study of the effects of health promotion programmes on knowledge, attitudes and self-care behaviours of older Taiwanese Aboriginal and non-Aboriginal adults with Type 2 diabetes in Taiwan". I hope to learn about your views and experiences of visiting public health stations, quality of life, daily activity related to diabetes self-care, and some medical record data about your diabetes control. You are being asked to participate in the study because you are a diabetes patient and are or have been receiving diabetes health services at local public health stations in Taiwan. If you participate, you will be one of approximately 200 diabetes patients in the study.

If you decide to participate, I will ask you to complete five questionnaires. These should take a total of 30 minutes. There is no risk in answering the questionnaires, except the time required, because your name will not be linked to your personal data or questionnaire responses. If any of the questions make you uneasy, you do not have to answer those questions. This study may help you to be more aware of your self-care in diabetes management and can be an opportunity for you to contribute to better diabetes care in the future. In addition, I will ask your permission to review your medical records to learn about your diabetes control, as an indicator of the quality of diabetes care at local public health stations in your community.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Your responses and medical records will not be linked to your name in any written or verbal report of this research project. Your decision to participate or to decide not to participate will not affect the health services you will receive or your relationship with your physician, health care providers, local public health stations of your community.

If you have any questions about the study or the questionnaires, please ask me. If you have any questions later, you may contact me on my private phone (Taipei, Taiwan) or via e-mail You may keep a copy of the cover letter for your records. You can also contact my supervisor if you have any concerns about the study (see details below).

You are making a decision whether or not to participate. Your signature below will indicate that you have read the information provided above and have decided to participate in the study. If you later decide that you do not want to participate in the study, simply tell me. You may discontinue your participation in this study at any time.
Thank you very much.

_____ _____

Printed Name of Participant

_____ _____

Signature of Participant Date

_____ _____

Signature of Investigator Date

I also authorize Ms. Chao, Ying-Hua to review my medical records. My medical records will be kept confidential. This medical record review is to be completed by January 30, 2006 and my authorization is withdrawn subsequent to this date.

_____ _____

Signature of Participant Date

_____

Chart number

Supervisor
Professor Kim Usher
Telephone: +617 47814261
Email: kim.usher@jcu.edu.au

APPENDIX F

Consent Form for Study
Chinese Version

同意書

您好,我很榮幸能邀請您參與這個問卷的研究計劃，我的博士論文主題是要「探討一個衛生教育對臺灣老年人糖尿病病患知識,態度及自我照顧行為的影響」。這個是我的博士論文計劃，我的名字叫做趙櫻花，現就讀澳洲詹姆士庫克大學護理博士班，這個計劃是為我的博士論文做準備，我希望了解您對糖尿病照護服務之看法以及您個人的糖尿病照顧的經驗。

如果您決定參與，我會請您花大約30分鐘填寫問卷，填寫問卷沒有任何的危險性，只是需要花您一點時間，您的名字將不會和您所填答的內容相連結，這個研究會幫助您比較了解您在糖尿病的自我照顧，也是一個您能對較高品質的糖尿病照護有所貢獻的機會。問卷中如果有任何讓您覺得不方便回答的問題，您可以不必回答每一個問題。

任何您所提供會被認出您個人的訊息都將保留隱私權，除非徵得您的同意，否則不會被透漏，您所填答的內容在發表口頭或書面研究結果的時候也將不會列出您的姓名，您決定參加與否不會影響任何醫療照護機構對您的服務，也不會影響您和衛生所醫護人員或澳洲詹姆士庫克大學的關係。

如果您有任何有關這個研究的問題，可以隨時問我，我的聯絡電話是
或用電子郵件和我聯繫，我的信箱是 yinghua.chao@jcu.edu.au 或；您也可以用英文直接和我的指導教授Usher博士聯繫，她的電子郵件信箱是 KimUsher@jcu.edu.au。

您可以保留這張說明做為參考。

您現在正在決定是否參加此研究，若您已經了解它的重要性並且同意參加,請在後面簽名，如果您決定不想繼續參加，請讓我知道，您可以隨時中斷參與，再次感謝。

_____ _____(關係:_____)

*參加者姓名(請以正楷書寫) 關係人(請以正楷書寫)(若參加者不識字)

_____ _____

*參加者(或關係人)簽名 日期

_____ _____

研究者簽名 日期

本人同意趙櫻花小姐因研究需要查閱我在診所的病歷,本同意書有效時間至民國 100 年 6 月 30 日止

_____ _____

立同意書人簽名 日期

APPENDIX G

Diabetes Questionnaires

Section 1: *DIABETES PERSONAL DATA SHEET

Code number:

Q1.☐ Male ☐ Female (please tick box)

Q2.Age (Birth date: _____)
☐ 50-54 ☐ 55-59 ☐ 60-64 ☐ 65-70 ☐ 70-74 ☐75-80 ☐>80

Q3.Level of education: ____ year
☐ None ☐ Elementary ☐ Junior ☐ middle High
☐ College/university and above

Q4.a.Occupation:
☐ None ☐ Soldier ☐ Government employee
☐ School teacher Labor ☐ Business ☐ Other (please indicate) _____

b.Characteristics of occupation:
☐ Regular schedule and location ☐ Iirregular location
☐ Iirregular schedule ☐ Iirregular both schedule and location

Q5.Marital status:
☐ Unmarried/single ☐ Married/cohabited ☐ Divorced/Separated
☐ Widow/Widower

Q6.Ethnicity (please indicate the most you feel like in your daily life):
☐ Mainlander ☐ Holo ☐ Hakka ☐ Amis ☐ Atayal
☐ Other (please indicate which tribe) : _____

Q7.Main language (The language that you usually use in daily life)
☐ Mandarin ☐ Holo ☐ Hakka ☐ Amis ☐ Atayal
☐ Other (please indicate which language) : _____

Q8. Who lives with you? (Please mark all that apply and circle the most important relationships if more than one category lives with you)
☐ I live alone
☐ I live with: ☐ My spouse ☐ My offspring(s) ☐ My parent(s)
☐ My relative(s) ☐ My friend(s)

Q9. Health insurance:
☐ Both of national health insurance and private Insurance
☐ National health insurance only
☐ None

Q10. Average monthly income (estimate):

Q11. Date diagnosed with diabetes: _____ (YYMM)

☐ 1-2years ☐ 2-5years ☐ 5-10years ☐ more than 10years

Q12. Known diabetes complications:

☐ Don't know

☐ No complication

☐ Yes, I have(Please indicate any complications you have experienced): ☐ Cataract

☐ Retinopathy (eye problem due to diabetes other than cataract)

☐ Kidney disease

☐ Heart disease

☐ Neuropathy(numbness of peripheral extremities)

☐ Foot problem (bad wound healing, debridement, or amputation)

Q13. Do you have any other chronic disease apart from diabetes

☐ No other disease:

☐ Yes (please indicate any chronic disease :

☐ High blood pressure

☐ High cholesterol

☐ Arthritis

☐ Tuberculosis

☐ Others:_____

Q14. a. In the past year, have you been hospitalized for intensive diabetes treatment or diabetes complications?

☐ No ☐ once ☐ twice ☐ three times and above

b. Length of stay: 1st: 2nd: 3rd:

c. Discharge diagnosis: 1st: 2nd: 3rd:

Q15. In the past year, your average pre-meal blood glucose was(a) ____

☐ (b) Don't know.

Q16. a. Your re cent pre-meal blood glucose was tested ____days ago.

b. How much was it? (a)_____ ☐ (b)Don't know.

Q17. a. Have you participated in a diabetes education program (multiple choices)

☐ Never

☐ Yes (please indicate all that apply as follows)

☐ Lecture diabetes education

☐ Group education with discussion

☐ Individual education

b. Has your family participated diabetes education?

☐ Yes ☐ No

c. How many hours did you have diabetes education over the past year?

- ☐ Less than 2 hours
- ☐ 3-4 hours
- ☐ 4-6 hours
- ☐ 6-8hours
- ☐ More than 8 hours

Q18. Your current treatment for diabetes is

- ☐ Oral medication only
- ☐ Insulin injection only
- ☐ Combined oral and insulin injection

Q19. Do you have a diabetes patient passport?

☐ Yes ☐ Has been lost ☐ No

Section 2[1]: *THE RAND SOCIAL HEALTH BATTERY

1. About how many families in your neighborhood are you well enough acquainted with, that you visit each other in your homes?
   _____Families

2. About how many close friends do you have—people you fell at ease with and can talk with about what is your mind? (You may include relatives.)(Enter number on line)
   _____Close friends

3. Over a year's time, about how often do you get together with friends or relatives, like going out together or visiting in each other's homes? (Circle one)

Every day	1
Several once a week	2
About once a week	3
2 or 3 times a month	4
About once a month	5
5 to 10 times a year	6
Less than 5 times a year	7

4. During the *past month*, about how often have you had friends over to your home? (Do not count relatives.) (Circle one)

Every day	1
Several once a week	2
About once a week	3
2 or 3 times a month	4
Once in past month	5
Not at all in past month	6

5. About how often have you visited with friends at their homes during the *past month?* (Do not count relatives.) (Circle one)

Every day	1
Several once a week	2
About once a week	3
2 or 3 times a month	4
Once in past month	5
Not at all in past month	6

6. About how often were you on the telephone with close friends or relatives during the *past month?* (Circle one)

Every day	1
Several once a week	2
About once a week	3
2 or 3 times a month	4
Once	5
Not at all	6

7. About how often did you write a letter to a friend or relative during the *past month?* (Circle one)

Every day	1
Several once a week	2
About once a week	3
2 or 3 times a month	4

Once in past month 5
Not at all in past month 6

8. In general, how well are you getting along with other people these days-would you say better than usual, about the same, or not as well as usual? (Circle one)

Better than usual 1
About the same 2
Not as well as usual 3

9. How often have you attended a religious service during the *past month?* (Circle one)
Every day 1
Several once a week 2
About once a week 3
2 or 3 times a month 4
Once in past month 5
Not at all in past month 6

10. About how many voluntary groups or organizations do you belong to-like church groups, club or lodges, parent groups, etc.(“ Voluntary” means because you want to.)
_____Groups or organizations
(Write in number. If none, enter“0”)

11. How active are you in the affairs of these groups or clubs you belong to? (If you belong to a great many, just count those you feel closest to. If you don’t belong to any, circle 4.) (Circle one)
Very active, attend most meetings 1
Fairly active, attend fairly often 2
Not active, belong but hardly ever go 3
Do not belong to any groups or clubs 4

Section 2[2]: ***Social services (original questionnaire)**

Q1. From what places or agencies have you received help over the last year?

Q2. What information about you, your family and your situation did service ask you when you asked or applied for help?

Q3. Of these places you told me about, from how many did you receive help at the same time?

Q4. How was it decided that you needed help?

Q5. Did you have a choice in deciding about getting help?

Q6. Do you know the names of the people who helped you?

Q7. Did the people who worked with you talk with each other about your situation?

Q8. What in your life or situation (or both) did you change as a result of the help you got?

Q9.Of the help you got, what most helped you in your life?

Q10.Do you think things are better since you got help?

Q11.If you could change anything about the way you get help when you need it, what would it be?

Q12.Did you have any financial support?

Q13.Did you have any education services in your community?

Q14.What kind of transportation do you and your family have available to you?

(adapted from Ervin 2004, pp. 59-60 by Chao,Ying-Hua, 28/09/2005)

***Social services (revised questionnaire)**

Q1. From what place or agency have you received main help over the last year?
□ hospital □ local government □ health station □ other □ none

Q2. What information about you, your family and your situation did

service ask you when you asked or applied for help? If you or your family have no any service ask, directly go to answer Q12
□ talk about my health problems to consultancy service □ tell consultancy service about my financial difficulties □ others □ no any asking

Q3. Of these places you told me about, which is your main receive help?
□ apply disabled handbook □apply allowance health □ consulting service or health examination □ others □ none

Q4. How was it decided that you needed help?
□ I am in financial difficulties □ my physical condition is not good □others suggesting □ others

Q5. Did you have a choice in deciding about getting help?
□ Yes, I can □ no, I cannot

Q6. Do you know the names of the people who helped you?
□ yes, I know them □ no, I don't know them

Q7. Did the people who worked with you talk with each other about your situation?
□ yes, they did □ no, they didn't □ I don't know

Q8. How improve your life or situation (or both) did you change as a result of the help you got?
□ not at all □ a little □ somewhat □ a great deal

Q9. Of the help you got, what most helped you in your life?
□ my financial condition □ my health condition
□ my interpersonal relation □ others

Q10. Of the help you got, have others helped you in your life (multiple selections)?
□ financial problems □ health problems □ interpersonal relation □ others □ none

Q11. If you could change anything about the way you get help when you need it, what would it be?
□ directly talk about my ask □ write a letter or e-mail □ call a phone □ other

Q12. Did you have any financial support?
□ yes □ no

Q13. Did you have any education services in your community?
□ yes □ no

Q14. What kind of transportation do you and your family have available to you?
□ take a walk □ take a public communication □ ride a bike □ ride a motorcycle □ take a bus □ other

(adapted from Ervin 2004, pp.59-60 by Chao,Ying-Hua, 30/12/2005)

Section 3: *THE HEALTH PERCEPTIONS QUESTIONNAIRE

Please read each of the following statements, and then circle one of numbers on each line to indicate whether the statement is true or false for you.

There are no right or wrong answers.

If a statement is definitely true for you, circle 5.

If it is mostly true for you, circle 4.

If you don't know whether it is true or false, circle 3.

If it is mostly false for you, circle 2.

If is definitely false for you, circle 1.

Some of the statement may look or seen like others. But each statement is different, and should be rated by itself.

		Definitely true	**Mostly true**	**Don't know**	**Mostly false**	**Definitely false**	**GHRI**	**Subscale ***
A.	According to the doctors I've seen, my health is now excellent.	5	4	3	2	1	.	CH
B.	I try to avoid letting illness interfere with my life	5	4	3	2	1		
C.	I seem to get sick a little easier than other people	5	4	3	2	1	.	RI
D.	I feel better now than I ever have before	5	4	3	2	1	.	CH
E.	I will probably be sick a lot in the future	5	4	3	2	1	.	HO
F.	I never worry about my health	5	4	3	2	1	.	HW
G.	Most people get sick a little easier than I do	5	4	3	2	1	.	RI
H.	I don't like to go to the doctor	5	4	3	2	1		
I.	I am somewhat ill	5	4	3	2	1	.	CH
J.	In the future, I expect to have better health than other people I know	5	4	3	2	1	.	HO

		Definitely true	Mostly true	Don't know	Mostly false	Definitely false	GHRI	Subscale *
K.	I was so sick once I thought I might die	5	4	3	2	1	.	PH
L.	I'm not as healthy now as I used to be	5	4	3	2	1	.	CH
M.	I worry about my health more than other people worry about their health	5	4	3	2	1	.	HW
N.	When I'm sick, I try to just keep going as usual	5	4	3	2	1		
O.	My body seems to resist illness very well	5	4	3	2	1	.	RI
P.	Getting sick once in a while is a part of my life	5	4	3	2	1		
Q.	I'm as healthy as anybody I know	5	4	3	2	1	.	CH
R.	I think my health will be worse in the future than it is now	5	4	3	2	1	.	HO
S.	I've never had an illness that lasted a long period of time	5	4	3	2	1	.	PH
T.	Others seem more concerned about their health than I am about mine	5	4	3	2	1		HW
U.	When I'm sick, I try to keep it to myself	5	4	3	2	1		
V.	My health is excellent	5	4	3	2	1	.	CH
W.	I expect to have a very healthy life	5	4	3	2	1	.	HO
X.	My health is a concern to my life	5	4	3	2	1		HW
Y.	I accept that sometimes I'm just going to be sick	5	4	3	2	1		SO
Z.	I have been feeling bad lately	5	4	3	2	1	.	CH
AA.	It doesn't bother me to go to a doctor	5	4	3	2	1		

		Definitely true	Mostly true	Don't know	Mostly false	Definitely false	GHRI	Subscale *
BB.	I have never been seriously ill	5	4	3	2	1	.	PH
CC.	When there is something going around, I usually catch it	5	4	3	2	1	.	RI
DD.	Doctors say that I am now in poor health	5	4	3	2	1	.	CH
EE.	When I think I am getting sick, I fight it	5	4	3	2	1		
FF.	I feel about as good now as I ever have	5	4	3	2	1	.	CH

During the past 3 months, how much has your health worried or concerned you? (circle one) HW

A great deal…….1
Somewhat…….2
A little…….3
Not at all……..4

- Subscale labels: CH = Current Health; PH = Prior Health; HO = Health Outlook; RI = Resistance to Illness; HW = Health Worry/Concern; SO = Sickness Orientation

Section 4: *SUMMARY OF DIABETES SELF-CARE ACTIVITIES QUESTIONNAIRE (SDSCA)

The questions below ask you about your diabetes self-care activities during the past 7 days. If you were sick during the past 7 days, please think back to the last seven days that you were not sick. Please circle the applicable number of days, and answer other questions if applicable.

Q1. On how many the last SEVEN DAYS have you followed a balanced food eating plan?
0 1 2 3 4 5 6 7

Q2. On average, over the past month, how many DAYS PER WEEK have you followed your eating plan?
0 1 2 3 4 5 6 7

Q3. On how many of the last SEVEN DAYS did you eat high fat foods such as red meat or full-fat diary products?
0 1 2 3 4 5 6 7

Q4. a. On how many of the last SEVEN DAYS did you eat at least 5 dishes of fruit and vegetable?
0 1 2 3 4 5 6 7
b. Select one that best explains your choice of fruits and vegetables
☐I ate a lot of vegetables, but I dislike fruits.
☐I don't eat lots of fruits because I am afraid too much sweets.
☐I ate a lot of fruit but dislike vegetable.
☐I ate a lot of both fruits and vegetables because I like them.

Q5. On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activities? (Total minutes of continuous activity, including walking)
0 1 2 3 4 5 6 7
__Yes, I did, but less than 30 minutes.

Q9. On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or as part of your work?
0 1 2 3 4 5 6 7

Q10. On how many of the last SEVEN DAYS did you (or your family/friend/or neighborhood health care personnel) test your blood glucose?
0 1 2 3 4 5 6 7

Q11. On how many of the last SEVEN DAYS did you (or your family/friend/or neighborhood health care personnel) test your blood glucose the number

of times recommended by your health care provider?
0 1 2 3 4 5 6 7

Q12. On how many of the last SEVEN DAYS did you check your feet?
0 1 2 3 4 5 6 7

Q13. On how many of the last SEVEN DAYS did you inspect the inside of your shoes?
0 1 2 3 4 5 6 7

Q14. On how many of the last SEVEN DAYS did you smoke a cigarette—even one puff—during the past SEVEN DAYS?
0 1 2 3 4 5 6 7

Self-Care Recommendation

Q1. Which of the following has your health care team (doctor, nurse, dietitian, or family/friend) advised you to do? Please tick all that apply:
☐ Follow a balanced food eating plan
☐ Follow an eating plan telling you how to distribute the amount of your food of each meal
☐ Follow a low-fat eating plan
☐ Reduce the number of calories you eat to loose weight
☐ Eat lots (at least 5 servings per day) of fruits and vegetables
☐ Eat very few sweets (for example: desserts, non-diet sodas, candy bars)
☐ Other (specify):
☐ I have not been given any advise about my diet by my health care team.

Q2. Which of the following has your health care team (doctor, nurse, dietitian, or family/friend) advised you to do? Please check all the apply:
☐ Just exercise frequently
☐ Exercise continuously for a least 20 minutes at least 3 times a week.
☐ Fit exercise into your daily routine (for example, park a block away and walk)
☐ Engage in a specific amount, type, duration and level of exercise.
☐ Other (specify): _____
☐ I have not been given any advise about exercise by my health care team.

Q3. Which of the following has your health care team (doctor, nurse, dietitian) advised you to do? Please check all the apply:

☐ Test your blood glucose using a machine to read the results.
☐ Go for neighborhood health care services to test your blood glucose.
☐ Other (specify):_____
☐ I have not been given any advice either about testing my blood or urine glucose level by my health care team.

Q4. Has your doctor's prescribed?
Which of the following medications for your diabetes has your doctor prescribed? Please tick all that apply:
☐ Only insulin injection
☐ Only diabetes pills to control my blood glucose level.
☐ Both insulin injection and diabetes pills
☐ Other (specify):_____
☐ I have not been prescribed either insulin or pills for my diabetes.

Q5. If you have insulin injection, do you have?
☐ An insulin shot 1 or 2 times a day
☐ An insulin shot 3 or more times a day.

Q6. If you have take oral pills, do you have?
☐ oral medication 1 or 2 times a day
☐ oral medication 3 or more times a day.

Q7. Which of the following has your health care team (doctor, nurse, dietitian, or family/friend) advised you to do? Please check all the apply:
☐ Check your feet every day.
☐ Dry the gaps between the toes after washing your feet.
☐ Warning about not wearing shoes for diabetes patients.
☐ I have not been given any advice either about testing my blood or urine glucose level by my health care team.

Q8. Have you been asked about smoking status when you visit clinic?
☐ Yes ☐ Never

Q9. a. If you are smoker, have you been talked about how to withdraw from smoking?
☐ Yes ☐ Never ☐ I don't smoke
b. If you are smoker, have you been referred to participate a class for withdrawal?
☐ Yes ☐ Never ☐ I don't smoke

Medication

Q1. On how many of the last SEVEN DAYS did you take your recommended oral diabetes medication?
0 1 2 3 4 5 6 7

Q2. On how many of the last SEVEN DAYS did you take your oral diabetes medication on time recommended?
0 1 2 3 4 5 6 7

Q3. On how many of the last SEVEN DAYS did you take your recommended insulin injection?
0 1 2 3 4 5 6 7

Q4. On how many of the last SEVEN DAYS did you take insulin injection on time recommended?
0 1 2 3 4 5 6 7

Foot Care

Q1. On how many of the last SEVEN DAYS did you wash your feet?
0 1 2 3 4 5 6 7

Q2. On how many of the last SEVEN DAYS did you dry the gaps between the toes after washing your feet?
0 1 2 3 4 5 6 7

Smoking

If you smoke, please answer question Q1 and Q2

Q1. When did you smoke last time?
- ☐ More than two years ago (or have not smoked)
- ☐ 1-2 years
- ☐ 4-12 months ago
- ☐ 1-3 months ago
- ☐ within last month
- ☐ within last week
- ☐ Today

Q2. How many cigarettes did you smoke on an average day? _____

Section 5: ***QUALITY of LIFE WHO-BREF TAIWAN VERSION (WHOQOL)(Back translation)**

Q1. In general, how would you evaluate your quality of life?
- ☐ not satisfactory at all
- ☐ somewhat satisfactory
- ☐ moderately satisfactory
- ☐ very satisfactory
- ☐ extremely satisfactory

Q2. In general, are you satisfied with your health?
- ☐ not satisfied at all
- ☐ somewhat satisfied
- ☐ moderately satisfied
- ☐ very satisfied
- ☐ extremely satisfied

Q3. To what extent do you feel that your diabetes hinders you in doing what you need to do?
- ☐ never hinders
- ☐ slight hindrance
- ☐ moderate hindrance
- ☐ great hindrance
- ☐ total hindrance

Q4. Do you need medical treatment to cope with your daily life?
- ☐ no need at all
- ☐ slight need
- ☐ moderate need
- ☐ great need
- ☐ extreme need

Q5. Do you enjoy your life?
- ☐ do not enjoy at all
- ☐ enjoy a little
- ☐ enjoy moderately
- ☐ enjoy greatly
- ☐ totally enjoy

Q6. Do you feel your life has meaning?
- ☐ none at all
- ☐ slight
- ☐ moderate
- ☐ great
- ☐ total

Q7. How good is your ability to concentrate?
- ☐ not good at all
- ☐ poor
- ☐ moderately good
- ☐ very good
- ☐ extremely good

Q8. How safe from injury do you feel in your daily life?
- ☐ not safe at all
- ☐ a little safe
- ☐ moderately safe
- ☐ very safe
- ☐ extremely safe

Q9. Do you live in a healthy environment (for example: pollution, climate, noise, transportation)?

- ☐ not healthy at all
- ☐ slightly healthy
- ☐ moderately healthy
- ☐ very healthy
- ☐ extremely healthy

Q10. Do you have enough energy for your daily life?

- ☐ no energy at all
- ☐ a little energy
- ☐ moderate energy
- ☐ great energy
- ☐ full of energy

Q11. Can you accept your appearance?

- ☐ no acceptance
- ☐ a little acceptance
- ☐ moderate acceptance
- ☐ great acceptance
- ☐ total acceptance

Q12. Do you have enough money for whatever you need?

- ☐ not enough at all
- ☐ almost enough
- ☐ just enough
- ☐ quite enough
- ☐ more than enough

Q13. Is it convenient for you to get the daily information you need?

- ☐ not convenient at all
- ☐ somewhat convenient
- ☐ moderately convenient
- ☐ very convenient
- ☐ extremely convenient

Q14. Do you have the opportunity to take leisure time?

- ☐ no opportunity at all
- ☐ some opportunity
- ☐ moderate amount of opportunity
- ☐ many opportunities
- ☐ every opportunity

Q15. How is your ability to get around?

- ☐ not good at all
- ☐ poor
- ☐ moderately good
- ☐ very good
- ☐ excellent

Q16. How satisfied are you with the sleep you get?

- ☐ not satisfied at all
- ☐ somewhat satisfied
- ☐ moderately satisfied
- ☐ very satisfied
- ☐ extremely satisfied

Q17. Are you satisfied with your ability to perform routine daily activities?

- ☐ not satisfied at all
- ☐ somewhat satisfied
- ☐ moderately satisfied
- ☐ very satisfied
- ☐ extremely satisfied

Q18. Are you satisfied with your working ability?

- ☐ not satisfied at all
- ☐ somewhat satisfied
- ☐ moderately satisfied
- ☐ very satisfied
- ☐ extremely satisfied

Q19. Are you satisfied with yourself?

- ☐ not satisfied at all
- ☐ somewhat satisfied
- ☐ moderately satisfied
- ☐ very satisfied
- ☐ extremely satisfied

Q20. Are you satisfied with your personal relationships?

- ☐ not satisfied at all
- ☐ somewhat satisfied
- ☐ moderately satisfied
- ☐ very satisfied
- ☐ extremely satisfied

Q21. Are you satisfied with your sexual life?

- ☐ not satisfied at all
- ☐ somewhat satisfied
- ☐ moderately satisfied
- ☐ very satisfied
- ☐ extremely satisfied

Q22. Are you satisfied with the support you get from your friends?

- ☐ not satisfied at all
- ☐ somewhat satisfied
- ☐ moderately satisfied
- ☐ very satisfied
- ☐ extremely satisfied

Q23. Are you satisfied with your living conditions?

- ☐ not satisfied at all
- ☐ somewhat satisfied
- ☐ moderately satisfied
- ☐ very satisfied
- ☐ extremely satisfied

Q24. Are you satisfied with how convenient it is for you to get medical services?

- ☐ not satisfied at all
- ☐ somewhat satisfied
- ☐ moderately satisfied
- ☐ very satisfied
- ☐ extremely satisfied

Q25. Are you satisfied with the transportation you use?

- ☐ not satisfied at all
- ☐ somewhat satisfied
- ☐ moderately satisfied
- ☐ very satisfied
- ☐ extremely satisfied

Q26. Do you often have negative feelings (for example: depression, despondency, anxiety, anguish)?

- ☐ Never
- ☐ sometimes
- ☐ rather frequently
- ☐ very frequently
- ☐ always

Q27. Do you feel respected by others?

- ☐ none at all
- ☐ slight
- ☐ moderate
- ☐ great
- ☐ total

Q28. Are you usually able to get the things you like to eat?

- ☐ never
- ☐ sometimes
- ☐ rather frequently
- ☐ very frequently
- ☐ always

The following questions are asking you about your satisfaction with quality of life in the recent 2 weeks. Please draw an arrow to indicate your rating and write down the number
of rating. “100” indicates the “best”; whereas, “0” indicates the “worst”.

For example:
How would you rate your health-related quality of life?

Worst						65				Best
0	10	20	30	40	50	60	70	80	90	100

1. In general, how would you rate your health-related quality of life?

Worst						65				Best
0	10	20	30	40	50	60	70	80	90	100

2. In general, how would you rate your quality of life before being diagnosed with diabetes?

Worst						65				Best
0	10	20	30	40	50	60	70	80	90	100

Section 6: **Medical Record Checklist**

Code number: _____

Measure	Over past 12 months (Date and data)	Frequency or Response
1. A1C		
2. Blood glucose (AC)		
3. Blood glucose (PC)		
4.Nephropathy assessment …Serum creatinine		
…Urine analysis		
…Micro albumin		
5. Lipid profile…Total Cholesterol		
…LDL-C		
…HDL-C		
…Triglyceride		
6. Blood pressure		
7.Ophthalmoscope Exam.		
8. BW (the first and last)		
9. Consulting DM team		

APPENDIX H

Human Ethics Report Form of JCU

This administrative form
has been removed

APPENDIX I

Human Ethics Consent
by Dr Tung

This administrative form
has been removed