DETERMINING FACTORS OF THE EFFECTIVENESS OF BLOOD GLUCOSE LEVEL CONTROL AMONG DIABETES PATIENTS IN MAEPRIK DISTRICT, LAMPANG PROVINCE, THAILAND

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ABSTRACT

A cross sectional study was conducted by interviewing 129 diabetes patients in Maeprik District, Lampang Province. This study aimed to describe determining factors of the effectiveness of blood glucose level control including socio-demographic factors, patient factors and knowledge about Diabetes Mellitus. Another objective was to measure blood glucose level control among diabetes patients.

The proportionate simple random sampling technique of registered diabetes patients in Maeprik health services was used for sampling size determination. A structured questionnaire was the research instrument. The effectiveness of blood glucose control level was categorized into two groups: good control and poor control.

The findings of the study revealed that 62.0% of the respondents had poor control and 38.0% of the respondents had good control. The trend of diabetes frequency was to increase with higher age. There were more female than male respondents. The majority of respondents had good adherence to DM clinic (79.1%) as well as taking diabetes medication regularly (84.5%). Overweight and obesity of respondents were widespread (62.0%). 43.4% of diabetes had comobidity of hypertension. The majority of respondents hadn't smoked (84.5%) or drank alcohol (88.4%). The majority of the respondents had a high level of knowledge about diabetes.

It was contradictory shown that blood glucose level control were statistically significant related to taking medication regularly (*p*- value = 0.027). And there was statistically significant association between blood glucose level control and cigarette smoking (*p*- value = 0.027).

Therefore, not only determining factors should be the center of attention, but also the raising of diabetes patients' awareness should be considered to improve the effectiveness of blood glucose control level among diabetes patients in this Maeprik District.

KEY WORDS: DIABETES/ BLOOD GLUCOSE LEVEL CONTROL

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LIST OT ABBREVIATIONS

ADA	**:**	American Diabetic Association
APPRO	**:**	The Asia – Pacific Perspective Redefining Obesity
BG	**:**	Blood Glucose
BMI	**:**	Body Mass Index
BP	**:**	Blood Pressure
CI	**:**	Confident Interval
CHRC	**:**	The Caribbean Health Research Council
DM	**:**	Diabetes Mellitus
DCCT	**:**	The Diabetes Control and Complications Trial
FBS	**:**	Fasting Blood Sugar
Hb A1C	**:**	Haemoglobin A1C
HBM	**:**	Health Belief Model
HT	**:**	Hypertension
IDF	**:**	International Diabetes Federation
IDDM	**:**	Insulin-Dependent Diabetes Mellitus
IGT	**:**	Impair Glucose Tolerance
IOTF	**:**	International Obesity Task Force
Kgs	**:**	Kilogram
M	**:**	Meter
mg/dl	**:**	Milligrams per deciliter
mmol/l	**:**	Millimol per liter
mmHg	**:**	Millimeters of mercury
NIDDM	**:**	Non-Insulin- Dependent Diabetes Mellitus
NIDDK	**:**	National Institute of Diabetes and Digestive and Kidney Diseases
OGTT	**:**	Oral Glucose Tolerance Test
SD	**:**	Standard Deviation
UKDPS	**:**	UK Prospective Diabetes Study
WHO	**:**	World Health Organization

CHAPTER 1
INTRODUCTION

1.1 Rationale and Justification

Diabetes mellitus (DM) in adults is a global health problem, although its prevalence varies widely between different populations and the rate has generally increased worldwide. DM is estimated to have a worldwide prevalence of 4.6% and afflict 200 million people. The prevalence is accelerating rapidly and the disease has reached epidemic proportions. The excess global mortality attributable to diabetes in the year 2000 was estimated to be 2.9 million deaths, equivalent to 5.2% of all deaths (1).

In 1994, the World Health Organisation (WHO) estimate for the prevalence of DM in Asia was 46.7 million, which is expected to rise to 126.2 million by the year 2010 and will reach 300 million in year 2025. In 1995, there were 830,000 people in Thailand suffered from diabetes and WHO estimated that the number will be doubled, 1,923,000 in the next two decades (2).

In Thailand, the diabetes prevalence rate for adults is increasing continuously. The prevalence of DM in general population also rose from 147.2 cases per 100,000 population in 1997 to 265.8 in 2005 (3) and 135 in people over sixty years (4). The prevalence noticeably increased among people aged 40 years and above (5). Death rates due to diabetes were about 11.85 per 100,000 populations in 2005(3).

As we enter the new millennium, Asia is being hit by an epidemic of diabetes and its related diseases. The rising prevalence of young onset diabetes which is closely associated with obesity and genetic factors is special challenges in the management of diabetic patients. Although diabetic patients have earlier mortality and increased risks for micro and macrovascular complications, there is strong evidence

that these devastating complications can be largely prevented by patient education, periodic assessments and use of appropriate therapeutic agents to optimize metabolic control and improve cardiovascular risk factors (6). The burden imposed by the chronic complications of diabetes is massive. Reduction of the modifiable risk factors and good blood glucose(BG) level control through public health efforts are essential (7).

DM is associated with significant morbidity and mortality derived from long-term microvascular and macrovascular complications of chronic hyperglycemia. The Diabetes Control and Complications Trial (DCCT) have clearly shown the benefits of intensive blood glucose level control for preventing or delaying the development and progression of long-term complications. Additionally, patient involvement is critical to intensive BG level control and should involve frequent self-monitoring of blood glucose, adherence to treatment regimens, and knowledge of the interrelationship among physical activity, diet, and insulin (8).

Action taken early in the course of diabetes is more beneficial in terms of quality of life and is more cost-effective, especially if this action can prevent hospital admission. It is an integrated component of clinical care and forms the basis for self-management. The objectives of diabetes control programme cannot be achieved unless effective educational programme are developed at all levels of care: primary, secondary and tertiary. Treatment should not only consider lowering blood glucose but also should focus on the correction of diabetes risk factors.

For health care systems should ensure that people with diabetes have access to the basic diabetes management services and proper follow up treatment for complications. Therefore, the effectiveness of treatment in diabetes patients will significantly reduce the severity and mortality of the diabetes and help controlling diabetes as well.

WHO believes that diabetes should be taken seriously by every one, so diabetes is an important public health disorder for many reasons:

- The disease is not only a problem for the individual but also is perceived as a societal challenge as well as because of its complications, seriousness and cost.

- The problems associated with diabetes are increasing.

- Effective preventive strategies already exist, but are not being rationally or widely utilized.

- The individual with diabetes makes 99.0% of his or her decisions concerning the disease outside the clinical setting, either at home, on the job, or with their existing community (9).

WHO has determined the objectives in taking care of diabetes patients in two main aspects.

- To maintain the health and quality of life of individuals with diabetes through effective patient care and education

- To prevent and threat diabetes complications and thereby decrease morbidity, mortality and the cost of DM treatment

It is not easy to achieve the above mentioned objectives unless all concern can cooperate well. Besides primary prevention, particularly secondary prevention through early detection and treatment is crucial to the success of these objectives (10). Today, people with diabetes can live active, independent lives if they take an active role in working with their healthcare team to manage their diabetes. Health systems that are able to deliver optimal care need to be designed around the needs of the person with the condition, as on a day to day basis most diabetes care is undertaken by the person with diabetes and not the health professional. Diabetes education plays a key role in empowering people with the knowledge and skills to manage their own condition effectively.

However, effective treatment may include education, nutrition, exercise, medication, weight control and lifestyle changes. An integral part of diabetes management is maintaining BG in as close to normal levels as possible. Accurate and consistent BG monitoring is essential to people with diabetes.

Maeprik District is a small district, the number of population is only 17,534; all residents are of Thai nationality and Buddhists. Almost inhabitants are farmer, poverty and low education. The Health delivery system consists of Maeprik Community Hospital that is the main contracting unit of primary care to support 6 networks of Health Centers. Conventional therapy is the major intervention in diabetes treatment.

In fiscal year 2005, there were 389 registered diabetes patients. DM morbidity rate of this area was 2.7%. Although, the health teams had managed diabetes care wonderfully by applied integration of health curative, health promotion, disease prevention, and health education programs together, DM still is one of the top five morbidity health problems in this area. Because of many factors affecting the condition of diseases particularly socio-demographic factors and patient factors were registered. These factors sometimes were ignored over the effectiveness in control of blood sugar level control which contributes to the pervasiveness of DM.

Although family history to diabetes is inevitable, if diabetes patients recognized to adjust lifestyle behavior and particularly alertness in determining factors, it could lead to the effectiveness of BG level control which could reduce DM complication, morbidity and mortality, respectively. Therefore, patients and health personnel must work together to support ongoing initiatives diabetes prevention, to manage diabetes and its complications, and to ensure improve the quality of diabetes care.

1.2 Research Question

- What factors determine the effectiveness of blood glucose level control among diabetes patients in Meaprik District from October 2005 to September 2006?

- What is the effectiveness of blood glucose level control among diabetes patients in Meaprik District from October 2005 to September 2006?

1.3 Research Objectives

1.3.1 General Objective

To study determining factors of the effectiveness of blood glucose level control among diabetes patients in Meaprik District from October 2005 to September 2006

1.3.2 Specific Objective

1.3.2.1 To describe determining factors of the effectiveness of blood glucose level control among diabetes patients including socio-demographic factors, patient factors and knowledge about DM such as age, gender, marital status, occupation, educational level, duration of having diabetes, adherence to visit DM clinic, regularity of taking medication, body mass index (BMI), hypertension (HT) status, diet control status, physical activity status, cigarette smoking and alcohol consumption,

1.3.2.2 To measure the effectiveness of blood glucose level control among diabetes patients,

1.3.2.3 To identify the association between the effectiveness of blood glucose level control in term of socio-demographic factors, patient factors and knowledge about DM.

1.4 Conceptual Framework

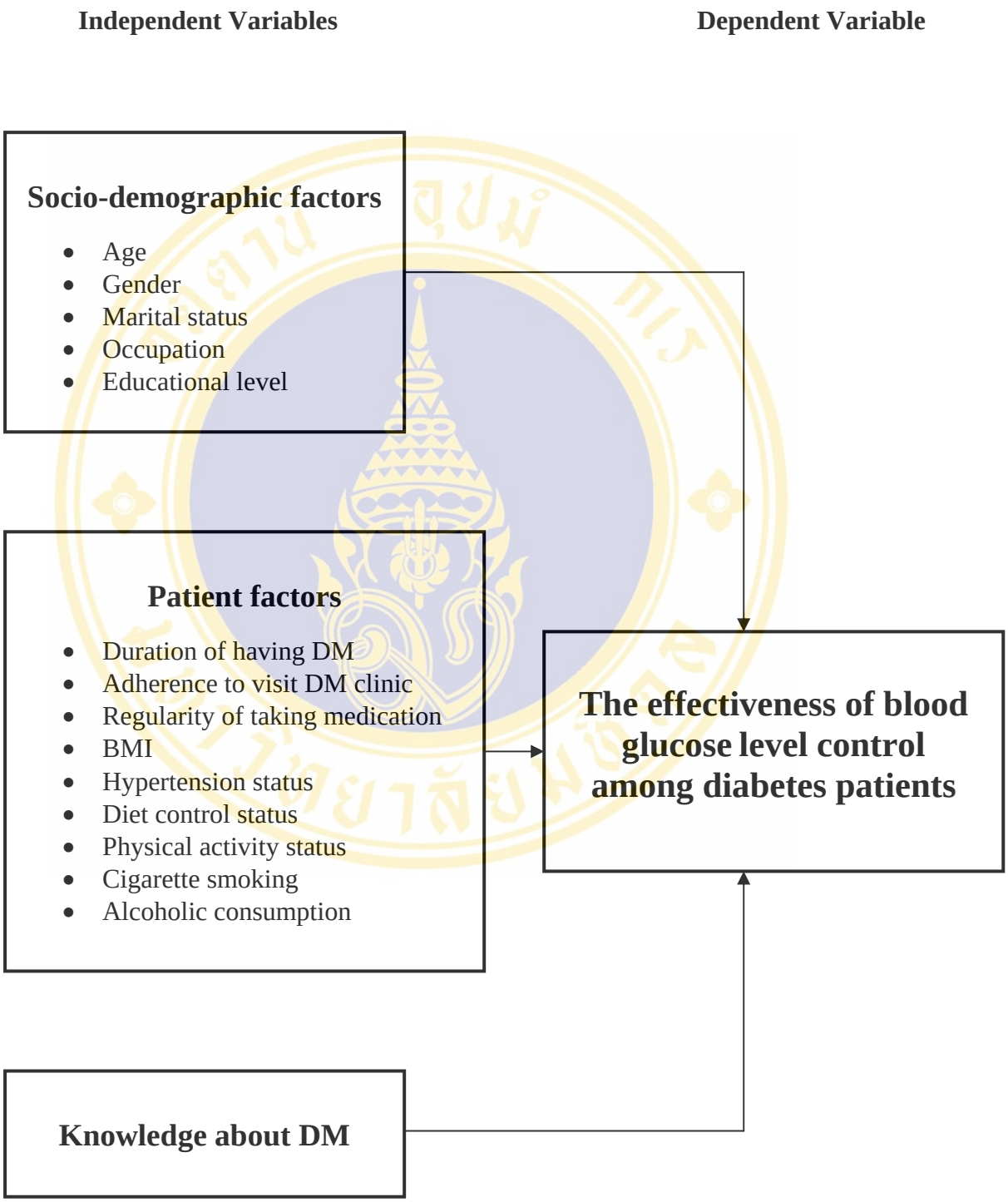


Figure 1 Conceptual Framework

1.5 Operational Definition

DM patients are clients who are diagnosed from any doctor and registered in a DM clinic under the Maeprik Hospital health services.

Blood glucose level is the amount of glucose in a given amount of blood or plasma. It is noted in milligrams in a deciliter, or mg/dl.

The assessment of the effectiveness of BG level control of diabetes patients could be evaluated from the mean of all the BG level results, in fiscal year 2005. This study was classified into 2 levels: if the BG level could control at less than and equal 120 mg/dl, it means *good BG level control*. If the BG level could control more than 120 mg/dl, it means *poor BG level control.*

Age refers to the length of time that diabetes patients has existed, usually expressed in years. This study has been categorized age into 5 groups; less than 50, 50-59, 60-69, 70-79 and 80 years or above.

Gender refers to either of the two reproductive categories of diabetes patients: Male or Female

Marital status refers to status which relating to marriage or the marriage of a particular couple of the diabetes patient. Marital status divides into 3 groups: Single, Married, and Widow.

Occupation is the job by which diabetes patients earn a living which has been categorized into 6 groups: Farmer and agriculture, Unemployed, Laborer, Merchant, Civil servant and others.

Educational level is the imparting and acquiring of knowledge through teaching and learning, especially at a school or similar institution. This study will be classified into 4 groups: Illiterate, Primary school, Secondary school and Higher than secondary school educational status.

Duration of having DM refers to duration of having DM from beginning of DM diagnosis by doctors and registered in a DM clinic. This study designs to 5 duration periods: less than 5, 5-10, 11-15, 16-20 and more than 20 years.

Adherence to visit DM clinic refers to the loyalty of diabetes patients to present at DM clinic when the medical authority appoint. In 1 specific year; it divides into 3 categories: good adherence means never missing adherence, fair adherence means 1 miss attendance, and poor adherence means more than 1 misses adherence.

Regularity of taking medication defines as cooperation with the recommendations of health core personnel or the consistency of patient behavior with a program of treatment as prescribed by a medical authority (4). The term's adherence gave been used to describe the extent to which patients engage in behaviors that are seen as health personnel's. Taking medication attendance will be categorized into 2 groups in 1 specific year that are regular group and irregular group.

Body Mass Index (BMI) refers to a measure used to evaluate body weight relative to a person's height. BMI calculate by weights in kilograms divide by height in meters by power of 2. This study refers the standard of The Asia – Pacific Perspective Redefining Obesity (APPRO) year 2000 (11). Standard BMI of adult Asia people are underweight (BMI < 20), normal weight (BMI = 20-23), overweight (BMI = 23.1-24.9), obese level 1 (BMI = 25-29.9) or obese level 2 (BMI >30).

Hypertension (HT) is defined as systolic blood pressure (SBP) of 140 mmHg or greater, and a diastolic blood pressure (DBP) of 90 mmHg or greater (12). In this study, HT status is condition that is diagnosed from any doctor which it is the main co-disease and classified into the present and absent of HT.

Diet control status refers to ability of diabetes patients to restrict eating behavior that corresponded to diabetic diet program. The assessment will be evaluated from diet behavior of diabetes patients in the last week both suitable type of rice and food. This study was applied the criteria of diabetes diet program followed socio-demographic of

patients' lifestyle of Maeprik district. This study, the appropriated rice for diabetes patients are steam or boil rice. The vegetable, fruit, chili paste and unsaturated food are the suitable foods in diabetes patients. If patients select both the appropriated diet in majority and the appropriated food for diabetes, it means, the patients had appropriate diet control status. This study has divided into 2 groups: appropriate and inappropriate diet control behavior.

Physical activity status refers to exiting diabetes patients' behavior in proper exercise which had shown by healthy subjects exercising for more than 30 minute at least three times weekly (15). The assessment will be evaluated from the practice in exercise behavior of diabetes patients in the previous week. This study was divided physical activity status into proper and improper physical activity.

Cigarette smoking refers to patient behaviors to consume cigarette smoking during past week. These factors represent to the risk behavior of patients that lead to the other complications such as cardiovascular disease and stroke. This study presents into consume characteristics; frequency, sometimes and never consume groups.

Alcoholic consumption refers to patient behaviors to drink alcohol during past week. These factors represent to the risk behavior of patients that lead to the other complications such as cardiovascular disease and stroke. This study presents into consume characteristics; frequency, sometimes and never consume groups.

Knowledge about DM refers to patients understanding about DM facts including definition, sign and symptoms, it complications, diabetes care, diabetes monitoring and treatment, diseases prevention and health promotion. The total score is 20. This study will be classified into 3 groups: Good (correct score 80.0 – 100 % or 17-20 mark), fair (correct score 60.0-80.0% or 12-16 mark) and Poor (correct score less than 60.0% or 0-11 mark)

1.6 Limitation of the Study

This study was focusing on the patient's variable. Other interest variables such as provider factors, health service variable, and structural variable are plays also important roles, but excluded in the study.

Regarding lipid profile is not declared in this study. Although lipid profile is important risk factors in diabetes, it was unavailable due to its costly.

Income also is main socio-economic variable. Under the benefit of 30 bath scheme and outreach services of Maeprik health delivery system were very effective and helpful to diabetes patients that minimized to diabetes patients' economic, so this study is rule out the income variable.

The accessibility should be considered in term of the different patients' facility to health services. This study didn't mention about accessibility due to all health services of Maeprik Health service network already distribute into every community and ease to access.

Actually, the treatment regimens also should be considered despite the researcher interest before. But the treatment regimens in the Community Hospital were always conventional treatment. So, the researcher believed that the respondents were under the same regimens according the reference of conventional regimen.

These impacts might be some effect to the validity and reliability of the effectiveness of BG level control among diabetes patients in this study.

CHAPTER 2
LITERATURE REVIEW

In studying determining of the effectiveness of blood glucose level control among diabetes patients in Maeprik district, Lampang province, Thailand, relevant literature reviews are as follows:

2.1 Concept and Theory

2.1.1 Theoretical Model: Health Belief Model (HBM)

The Health Belief Model has been applied to a broad range of health behaviors and subject populations. Three broad areas can be identified:

1) Preventive health behaviors, which include health-promoting and health-risk behaviors.
2) Sick role behaviors, which refer to compliance with recommended medical regimens, usually following professional diagnosis of illness.
3) Clinic use, which includes physician visits for a variety of reasons.

The Health Belief Model was developed in the early 1950s. The concepts of this model was influenced by the theory of Kurt Levin, believing that the perception of the

person is the indicator of the behavior in which the person will be close to what they desire and believe to cause benefits and will stay away from their undesirable things. Important components in HBM that has concluded are primary concepts stating that perception and expectation of the person are the behavioral indicators. In general, it is now believed that individuals will take action, when they regard themselves as susceptible to the condition, believe it to have potentially serious consequences, believe that a course of action available to them would be beneficial in reducing either their susceptibility to or the severity of condition, and believe that the anticipated barriers to taking the action are outweighed by its benefits (5).

The HBM was a systematic method to explain and predict the health behavior. It related with health behavior, utilization of health services and general health motivation for the purpose of distinguishing illness and sick-role behavior from health behavior (3). Four key health beliefs:

Perceived Susceptibility

The dimension of perceived susceptibility refers to one's subjective perception of risk of contracting a health condition. In the case of medically established illness, the dimension has been reformulated to include acceptance of the diagnosis, personal estimates of resusceptibility will see the importance of being healthy. Therefore, the perceived susceptibility is the important factor of predicting the preventive behavior of the person. Application of this study, all registered diabetes patients those who perceived susceptibility had accepted to diabetes diagnosis and agree to cooperate with diabetes program for BG level control. To avoid DM complications and improve the quality of life were main aim of diabetes patients.

Perceived Severity

Feelings concerning the seriousness of contracting an illness or of leaving it untreated include evaluations of both medical and clinical consequences and possible social consequence such as effects of the conditions on work, family life, and social relations. Diabetes patients those who feel concerning the seriousness or its complications or consequence, it showed the patients had already perceived severity.

Perceived Benefits

While acceptance of personal susceptibility to a condition also believed to be serious (perceived threat) is held to produce a force leading to behavior, it does not define the particular course of action that is likely to be taken. This is hypothesized to depend upon beliefs regarding effectiveness of the various available actions. Thus, an individual exhibiting an optimal level of beliefs in susceptibility and severity would not be expected to accept any recommended health action unless that action was perceived as feasible and efficacious. For example in case of DM, some of diabetes patients' action took early to adjust lifestyle and behavior for effectively BG level control. Because they already perceived benefit of preventive action, they try to changing their behavior.

Perceived Barriers

The potential negative aspects of a particular health action, or perceived barriers, may act as impediments to undertaking the recommended behavior. A kind of non-conscious, cost-benefit analysis is thought to occur wherein the individual weighs an action's effectiveness against perceptions that it may be expensive, dangerous (having negative side effects or iatrogenic outcomes), unpleasant (painful, difficult, upsetting), inconvenient, time consuming and so forth. Thus, "The combined levels of susceptibility and severity provided the energy or force to act and the perception of benefits (fewer barriers) provided a preferred path of action". Diabetes patients had many perceived barriers to control of BG level including some of socio-demographic variables, patient variables, structural, variables etc.

Perceived severity of DM and perceived benefits of screening and follow-up treatment were associated with more effective self-management report regimen adherence scale and increasing adherence. It is helpful if the patient is concerned about: their health, their susceptibility to illness, the severity of their disease condition as they perceive it and the personal benefits and cost of good health habits.

It is helpful if the health is team takes time to assess the patient's habit and beliefs and to identify those, which are detrimental or conductive to proper care as

well. There is positive relationship between chronically all diabetes patients' belief and their subsequent behaviors.

HBM is an example of expectancy-value theories. The value attached to an outcome depends upon individual perception of how a disease will interfere with future health, cause extended periods of illness, or limit achievement of other social or personnel goal. Expectation for positively valued outcome leads to overcome barriers and complete the barriers (5).

Therefore, it believes that if the patient perceived susceptibility to DM, perceived threat of diabetes and awareness of perceived benefits overcome perceived barriers of patient factors and DM treatment it conducts to the people's and patient's compliance in follow-up BG level. However there are some variables that an influence an individual's decision such as socio-demographic variable, health services variable, structural variable etc. should be considered.

Application of HBM to this study was mainly to explain the perception of the diabetes patients in term of preventing DM complications even though perception didn't declare in the conceptual framework. The registered diabetes patients seem to perceived susceptibility to DM while some of them perceived seriousness of DM and some diabetes patients previously perceived threat of DM and its complication. Many patients had adjusted their preventive behavior and lifestyles in which they will be close to what they desire and believe to cause benefits and will stay away from their complications of DM. Life modifications of diabetes patients are the instance for this support including reduce smoking, diet control, exercise, reduce weight, etc. There are many modify factors relating to DM including socio-demographic variables (i.e. age, gender etc) and structural variables (i.e. knowledge about DM). Regarding this study, the researcher conducted many factors which some factors, including socio-demographic factors and patient factors, may be benefits or barriers to the effectiveness of BG level control.

About the Sick Role, sociologists conceptualize *social roles* as the expected behaviors (including rights and obligations) of someone with a given position (status) in society. Generally, people *hold a status* (position) and *perform a role* (behaviors).

In 1951 Talcott Parsons utilized these concepts to construct a theoretical view of individuals who are sick, hence the "sick role." This theory outlines two *rights* and two *obligations* of individuals who become sick in our society.

Rights:

The sick person is exempt from "normal" social roles. An individual's illness is grounds for his or her exemption from normal role performance and social responsibilities. This exemption, however, is relative to the nature and severity of the illness; the more severe the illness, the greater the exemption. Exemption requires legitimation by the physician as the authority on what constitutes sickness. Legitimation serves the social function of protecting society against *malingering* (attempting to remain in the sick role longer than social expectations allow – usually done to acquire *secondary gains* or additional privileges afforded to ill persons).

The sick person is not responsible for his or her condition. An individual's illness is usually thought to be beyond his or her own control. A morbid condition of the body needs to be changed and some curative process apart from person will power or motivation is needed to get well.

Obligations:

The sick person should try to get well. The first two aspects of the sick role are conditional upon the third aspect, which is recognition by the sick person that being sick is undesirable. Exemption from normal responsibilities is temporary and conditional upon the desire to regain normal health. Thus, the sick person has an obligation to get well.

The sick person should seek technically competent help and cooperate with the physician. The obligation to get well involves a further obligation on the part of

the sick person to seek technically competent help, usually from a physician. The sick person is also expected to cooperate with the physician in the process of trying to get well (16).

This concept is a valuable contribution to understanding illness behaviors and social perceptions of diabetes. A number of criticisms of Sick Role theory, including: a violation in the “ability to get well” for a number of conditions, particularly diabetes; individuals or groups may not possess the resources to “seek technically competent help” or to “cooperate with the physician” based upon health insurance, income, role conflicts to compliance, etc.; certain illnesses of diabetes may reflect an element of personal “blame” due to unhealthy lifestyle choices (i.e. smoking, alcoholic consumption); the potential inability to be “exempt from normal social roles” due to issues of status (i.e. parent, family members), gender, age, etc. In this study, almost patient factors relate to sick role theory including adherence to visit DM clinic, the regularity of taking medication, diet control behavior, physical activity status, smoking and alcoholic consumption due to if diabetes patients try to positively cooperate with these factors, the outcome were theoretically glowing later on.

However, the Sick Role does exist at some level in society, then in regards to more general social beliefs about the expectations for individuals who are diagnosed with diabetes. Therefore, the expected behaviors of diabetes patients with a given status in society should be consider. Generally, people *hold a status* (position) and *perform a role* (behaviors).

Stiggelbout and Kiebert (17) studied a role for the sick role, Patient preferences regarding information and participation in clinical decision-making. Their objective was to assess whether patient preferences regarding information and participation in decision-making about treatment options are related to patient characteristics and the context of the decision. The conclusion was the lack of strong predictors of a preferred decision-making role implies that clinicians need to assess every patient individually to determine what role he or she prefers. The finding that the patients preferred a more passive role than their companions suggests that the "sick role"

influences the preference regarding participation more strongly than the type of decision to be made or the presence of a life-threatening disease. This hypothesized shift in preference among subjects who are sick implies that these patients need encouragement to participate as well as diabetes patients.

2.1.2 Research relates to Health Belief Model in Preventing DM

Wipawon (18) studied the effect of participatory guidance on Health Belief and Self-Care behavior for prevention in the diabetes mellitus risk people in Bangbuahong District of Nontaburi Province. The experimental group received the participatory guidance twice about the knowledge of diabetes, perceived susceptibility, perceived severity, and perceived benefits and barriers of diabetes prevention, exercising, and stress management. The researchers recorded their self-care behavior and weight. The results of the study indicated that the experimental group had the mean score of Health Belief Model and Self-Care behavior higher when compared with the pre-test and higher than the comparison group, and have lower body mass index lower than the pre-test and than during the comparison group with statistical significance.

2.2 Knowledge about DM and Determining Factors

2.2.1 Diabetes Mellitus

Diabetes is a group of diseases marked by high levels of BG. Diabetes is a disorder of metabolism. Diabetes can lead to serious complications and premature death, but people with diabetes can take steps to control the disease and lower the risk of complications (34).

Types of Diabetes

1. Type 1 diabetes was previously called *insulin-dependent diabetes mellitus (IDDM)* Type 1 diabetes is an autoimmune disease. This form of diabetes usually strikes children and young adults, although disease onset can occur at any age. Type 1 diabetes accounts for 5.0% to 10.0% of all diagnosed cases of diabetes. Symptoms may include increased thirst and urination, constant hunger, weight loss, blurred vision, and extreme fatigue.

2. Type 2 diabetes was previously called *non–insulin-dependent diabetes mellitus (NIDDM)* Type 2 diabetes accounts for about 90.0% to 95.0% of all diagnosed cases of diabetes. Type 2 diabetes is associated with older age, obesity, family history of diabetes, history of gestational diabetes, impaired glucose metabolism, physical inactivity, and race/ethnicity. About 80.0% of people with type 2 diabetes are overweight. The symptoms of type 2 diabetes develop gradually. Symptoms may include fatigue, frequent urination, increased thirst and hunger, weight loss, blurred vision, and slow healing of wounds or sores. Some people have no symptoms.

3. Gestational diabetes is a form of glucose intolerance diagnosed in some women during pregnancy. It is also more common among obese women and women with a family history of diabetes. Women who have had gestational diabetes have a 20.0% to 50.0% chance of developing diabetes in the next 5–10 years.

4. Other types of diabetes result from specific genetic conditions (such as maturity-onset diabetes of youth), surgery, drugs, malnutrition, infections, and other illnesses. Such types of diabetes account for 1% to 5% of all diagnosed cases (34).

Glucose Measurement:

Urine glucose measurement is both insensitive and relatively non-specific for the detection of diabetes.

Oral glucose tolerance testing was as cost effective and more efficient for diagnosing diabetes after abnormal fasting serum glucose test (4) than were repeat fasting serum glucose determinations.

Hemoglobin A1C did not reliably predict impaired or diabetic glucose tolerance.

While *fasting plasma glucose* was the best test for screening, but glycated hemoglobin and quantitative urine glucose also provided high specificity with sensitivities approximately 80.0% or higher (6).

The fasting blood glucose test is the preferred test for diagnosing diabetes in children and non-pregnant adults. It is most reliable when done in the morning. A diagnosis of diabetes can be made based on any of the following test results, confirmed by retesting on a different day:

- A blood glucose level of 126 milligrams per deciliter (mg/dl) or more after an 8-hour fast. This test is called the fasting blood glucose test.

- A blood glucose level of 200 mg/dl or more 2 hours after drinking a beverage containing 75 grams of glucose dissolved in water. This test is called the oral glucose tolerance test (OGTT).

- A random (taken at any time of day) blood glucose level of 200 mg/dl or more, along with the presence of diabetes symptoms.

Complications from DM

Diabetes is widely recognized as one of the leading causes of death and disability. About 65% of deaths among those with diabetes are attributed to heart disease and stroke. Diabetes is associated with long-term complications that affect almost every part of the body. The disease often leads to;

- *Eye problems*: High BG can cause blurred vision, and poorly-controlled diabetes can lead to blindness.

- *Foot problems*: Diabetes can damage both the nerves and the blood vessels to the feet leading to numbness, burning “pins and needles” feeling, poor circulation and possibly amputation.

- *Cardiovascular complications*: Diabetes, especially in people with high BP and high cholesterol, causes heart disease. Heart disease is the number 1 killer of people with diabetes.

- *Kidney complications*: High BG, especially if combined with high BP, can cause kidney damage and lead to dialysis.

- *Nerve complications*: High BG can damage nerves in any part of the body.

- *Respiratory complications*: People with diabetes are more likely to die with pneumonia or influenza than people who do not have diabetes.

- *Dental complications*: High BG can cause gum disease or periodontal disease and gum disease can cause high BG.

- *Stroke*: People with diabetes are 2 to 4 times more likely to suffer a stroke than people without diabetes**.**

- *Stomach problem*: Poorly-controlled diabetes can cause nerve damage to the stomach leading to nausea, poor digestion, and bloating (21).

Long-term microvascular and macrovascular complications of DM cause significant morbidity and mortality. Microvascular sequelae may lead to visual disabilities and blindness, renal failure, sensory loss, and limb damage with possible need of lower extremity amputation. Long-term macrovascular complications include cardiovascular, cerebrovascular, and peripheral vascular disease and are associated with a two- to fourfold increase in premature cardiac disease and death compared with individuals without diabetes. Two landmark studies, DCCT and the UK Prospective Diabetes Study (UKPDS) Group (1998) conclusively showed the significant benefits of improving BG level control with intensive treatment on the long-term complications of the disease (8).

Treating Diabetes

The first treatment for type 2 diabetes is often exercise and meal planning for blood sugar control and weight loss. Sometimes these measures may not be sufficient to bring BG levels back to normal range. The next step is usually taking an oral

medication to help decrease your insulin requirements or cause your body to produce more insulin (20). Among adults with diagnosed diabetes, found that 16% take insulin only, 12% take both insulin and oral medication, 57% take oral medication only, and 15% do not take either insulin or oral medications (19). Many people with type 2 diabetes can control their BG by following a healthy meal plan and exercise program, losing excess weight, and taking oral medication. Diabetes self-management education is an integral component of medical care.

To achieve targets of diabetes control, diabetes must never be managed based on symptoms alone. The targets are based on evidence of what levels of abnormality constitute an added health risk. Failure to approach the targets, if this could be done without deterioration in quality of life, is inadequate care. It is however inappropriate to approach target levels too closely when this adversely affects the patient, treatment goals must then be individualized.

Today, healthy eating, physical activity, and BG testing are the basic management tools for type 2 diabetes**.** In addition, many people with type 2 diabetes require oral medication, insulin, or both to control their BG levels. People with diabetes must take responsibility for their day-to-day care. Much of the daily care involves keeping BG levels from going too low or too high. People with diabetes should see a health care provider who will help them learn to manage their diabetes and who will monitor their diabetes control.

The goal of diabetes management is to keep levels of BG, BP, and cholesterol as close to the normal range as safely possible. Keeping BG levels close to normal reduces the risk of developing major complications of diabetes (22).

Monitoring Blood Glucose

Controlling your BG is essential to feeling healthy and avoiding long-term complications of diabetes. Some people are able to control their BG with diet and exercise alone. Others may need to use insulin or other medications in addition to

lifestyle changes. In either case, monitoring your BG is a key part of your treatment program.

The best range for you depends on your age and the type of diabetes you have. For younger adults who don't have complications of diabetes, a typical target range might be 80 to 120 mg/dL before meals and below 180 mg/dL after eating. Older adults who have complications from their disease may have a fasting target goal of 100 to 140 mg/dL and below 200 mg/dL after meals. That's because BG that falls too low in older adults can be more dangerous than in younger people (23).

2.2.2 Epidemiological Situation of DM and Risk in Thailand

According to global situation, the prevalence varies widely between different populations and the rate has generally increased worldwide. In Thailand, the diabetes prevalence rate also noticeably increased as well as mortality rate. The prevalence of diabetes in Thailand also rose from 33.3 cases per 100,000 populations in 1985 to 265.8 in 2005 (3). The prevalence of compliance of DM in out patient department was 46.9% only. Risk factors are also important determinants to the effectiveness of diabetes treatment as well.

This part will be shown epidemiological situation of DM and some risk factors in Thailand in the past which these data were not only relate to the effectiveness of diabetes treatment but also communicate to some considerably determining factors of diabetes.

The prevalence of diabetes has escalated worldwide as a result of rapid economic development and associated changes in life expectancy. Contributing factors include changes in living conditions, employment and occupation, food affordability, availability and diet, increased stress in daily living, physical inactivity and rises in obesity. Without effective control of the disease, the macro- and micro-vascular complications develop, resulting in substantial direct and indirect economic and social costs for individuals, communities and national governments (24). Table 1

shows the number of total population in 2002, projected population in 2020, Average life expectancy (year) in 2001and Uncertain interval of Thailand.

Table 1 Uncertain Interval in Average Life Expectancy in Thailand 2001 (25)

	Males	**Females**
2002 Total Population	30,561,207	31,632,143
2020 Projected Population	36,918,130	38,177,920
2001Average life expectancy (year)	65.7	72.2
Uncertain interval	64.4 - 66.6	70.9 - 73.2

Diabetes

Table 2 and Figure 2 show how the prevalence increased with age in both sexes, from 4.0-5.0% in 35-44 years age and rising to the peak rate of 16.0-17.0% among over 65 years age in 1996-1997.

Table 2 Diabetes-Prevalence-Fasting Glucose Blood Sample in 1996-1997 by Age Group, Thailand (25)

Gender	**Age group**	***Prevalence (%)***
Male	35 - 44	4.4
	45 - 54	10.0
	55 - 64	13.1
	≥ 65	17.6
	≥ 35	9.3
Female	35 - 44	5.3
	45 - 54	9.6
	55 - 64	14.9
	≥ 65	16.8
	≥ 35	9.9

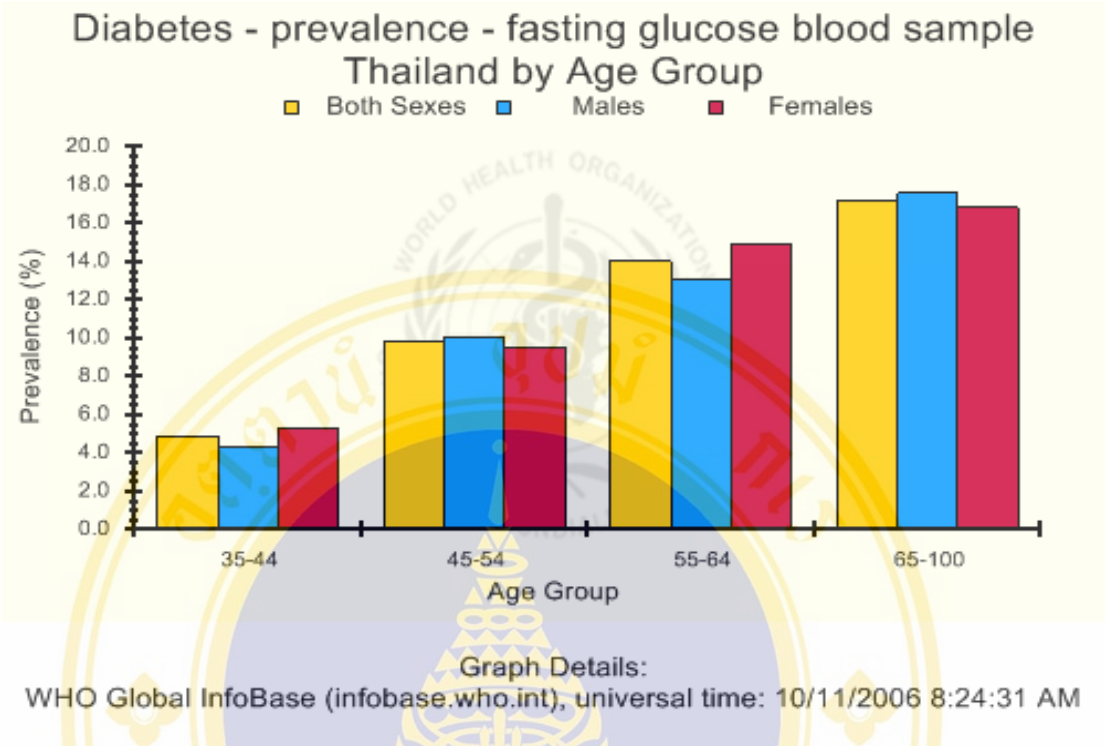


Figure 2 Diabetes-Prevalence-Fasting Glucose Blood Sample in Thailand by Age Group (25)

Mean Glucose Value

Table 3 and Figure 3 show mean glucose value are slightly difference, 5.2-5.9 mmol/l, in all age groups and both gender. For diabetes diagnosis is 7 mmol/l (equivalent to 126 mg/dl).

Table 3 Mean Glucose Value by Gender and Age Groups in year 2000, Thailand (25)

Sex	**Age groups**	***Mean***	***± SD (95%CI)***
Male	35 - 44	5.5	(5.2-5.7)
	45 - 54	5.6	(5.4-5.9)
	55 - 64	5.7	(5.4-6.0)
	≥ 65	5.9	(5.6-6.1)
	≥ 35	5.6	(5.4-5.8)
Female	35 - 44	5.2	(5.0-5.4)
	45 - 54	5.7	(5.4-5.9)
	55 - 64	5.9	(5.5-6.2)
	≥ 65	5.7	(5.4-5.9)
	≥ 35	5.5	(5.4-5.7)

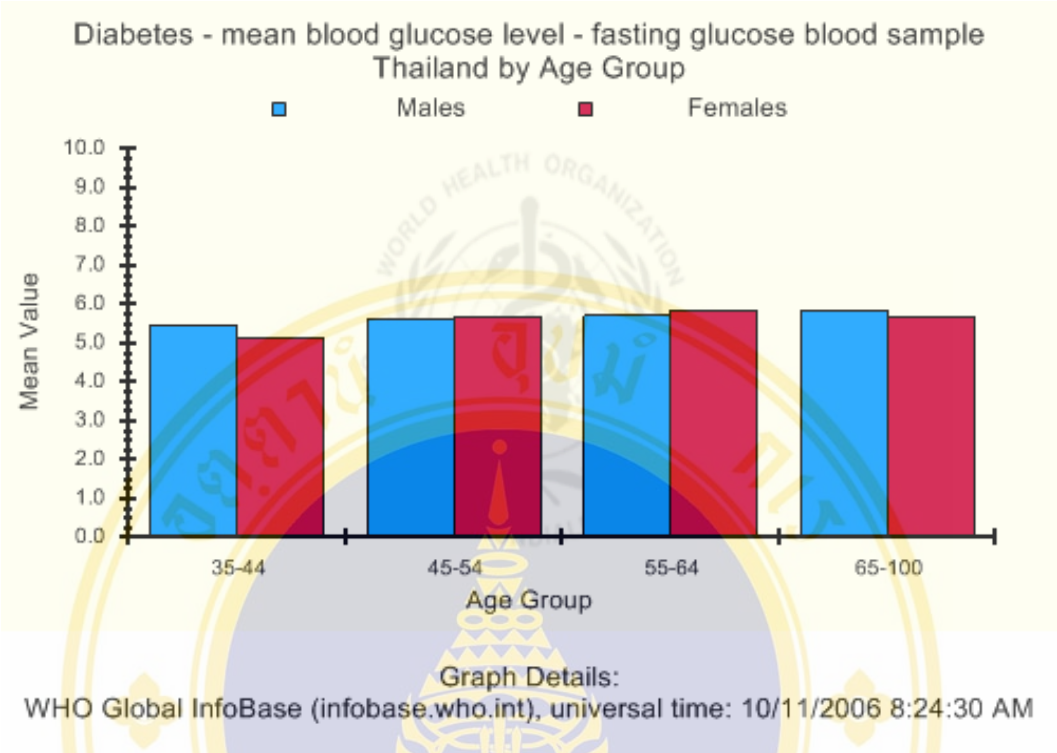


Figure 3 Mean Blood Glucose level – Fast Glucose blood Sample Thailand by Gender and Age Groups in year 2000, mmol/dl (7 mmol/l) (25)

During 1985- 2003, the mortality rate in the elderly have also risen for diabetes from 28.8 to 66.7; are shown in Table 4

Table 4 Mortality rate of DM among the Elderly, 1985-2003 (26)

Year	Rate	Year	Rate
1985	28.8	1995	56.2
1986	24.9	1996	57.4
1987	30.3	1997	48.5
1988	32.4	1998	47.7
1989	37.2	1999	74.8
1990	39.4	2000	82.1
1991	39.9	2001	88.4
1992	49.5	2002	72.1
1993	50.8	2003	66.7
1994	57.2		

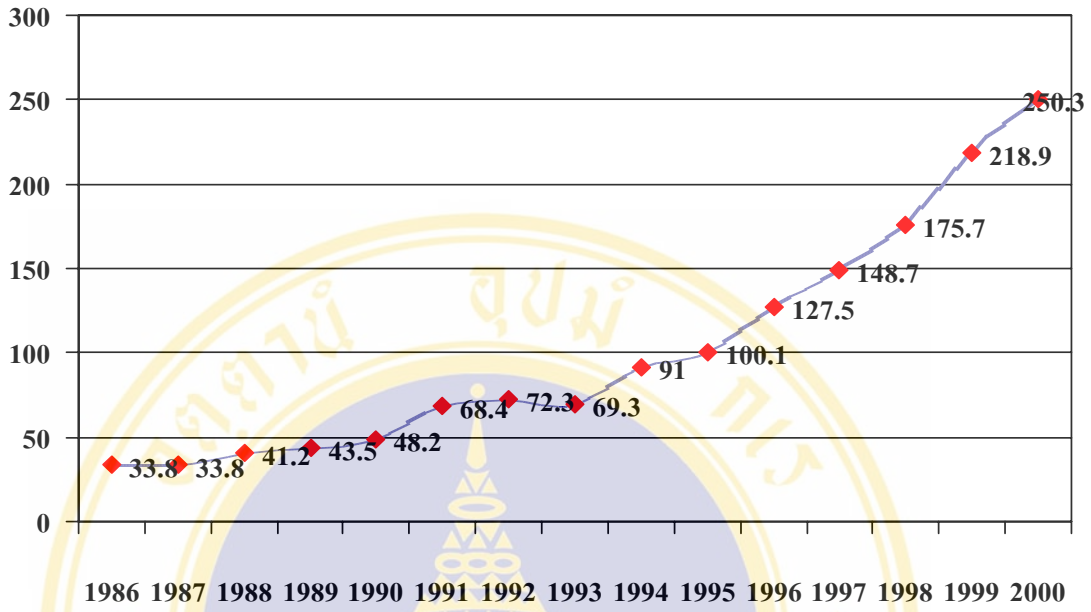


Figure 4 The Admission Rate in Government Hospital per 100,000 population, during 1986-2000 (27)

According to Figure 4, the admission rate in hospital also increased from 33.8 cases per 100,000 populations in 1986 to 250.3 in 2000

Risk Factors

- **Obesity**

Table 5 Prevalence of Obesity by Sex and Age Groups in 1996 -1997, Thailand (28)

Sex	Age group	*n*	*Prevalence (%)*	*95% CI*
Male	13 - 59	1649	18.8	16.9-20.7
Female	13 - 59	2581	28.6	26.9-30.3

Table 5 shows female obesity to be more than male when definition used of Obesity is BMI $\geq$ 25.

- **Mean Body Mass Index (kg/m²)**

Table 6 Mean Body Mass Index by gender in each Age Group in 2000, Thailand (29)

Sex	**Age groups**	***Mean***	***± SD (95%CI)***
Male	35 - 44	23.1	(22.4-23.9)
	45 - 54	23.8	(23.1-24.4)
	55 - 64	22.6	(21.8-23.4)
	≥ 65	22.0	(21.4-22.6)
	≥ 35	23.1	(22.7-23.5)
Female	35 - 44	25.2	(24.7-25.6)
	45 - 54	25.9	(25.3-26.5)
	55 - 64	24.5	(23.7-25.3)
	≥ 65	22.6	(21.9-23.3)
	≥ 35	24.8	(24.5-25.2)

Table 6 and Figure 5 show in year 2000, BMI in female are more than male in every age group. The peak of BMI is 45-54 years and decline tendency when more ages in both genders.

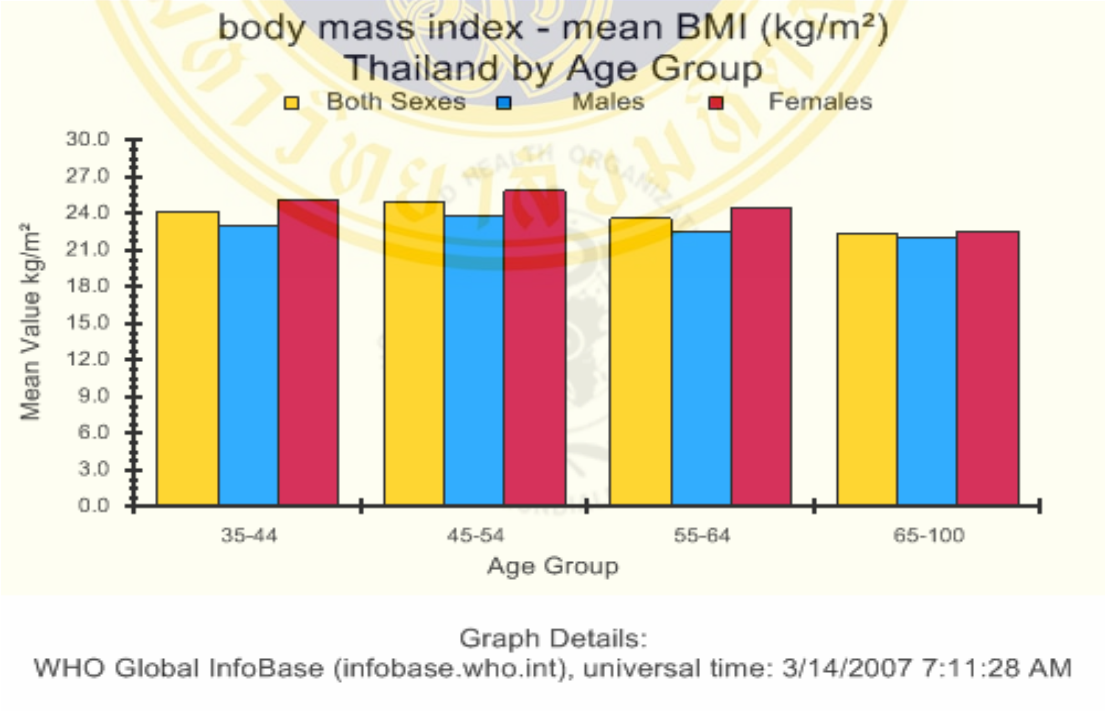


Figure 5 Mean Body Mass Index by Gender in each Age Group in 2000, Thailand (25)

2.2.3 Determining Factors of the Effectiveness of Blood Glucose Level Control and Research Related

UKPDS was a landmark, clearly demonstrating that intensive BG level management of type 2 diabetes significantly reduced both microvascular and macrovascular complications. Although diet and lifestyle interventions remain pivotal to the management of this chronic condition, the importance of structured patient education and self-management is increasingly recognized.

Type 2 diabetes is one of the most common chronic diseases. In the management of chronic disease, patient empowerment and supported self-care are pivotal. All patients with diabetes will 'receive a service which encourages partnership and decision making, supports them in the management of their diabetes, and helps them to adopt and maintain a healthy lifestyle'. In practice, this means that principles of care are used to develop the individual's understanding of diabetes, the specific diabetes (e.g. monitoring) and general self-management (e.g. goal-setting) skills necessary for effective self-management, and the confidence necessary to become an effective manager of his or her diabetes (30).

Self-care behaviors included any of the following: taking medicine regularly, reducing weight, avoiding cigarettes or alcohol, exercising, practicing diet control, and maintaining a regular life style and avoiding late hours. The factors considered were socio-demographic factors including age, sex, education, income, and health behavior factors including smoking, drinking alcohol, and health conditions such as existence of other chronic diseases, limitation of activity of daily living, and self-perceived health (31).

Strict adherence to self-care regimens is crucial for diabetes patients to live a relatively normal life. These complex routines must be followed daily, and often for the rest of the patients' lives. The nature and complexity of the treatments required to successfully manage diabetes demands strict adherence to not only the doctor's advice, but to patient record keeping of glucose levels, so that the physician can

review these results and changes can be made if necessary to the patient's self-care regimen (32).

Several factors influence diabetes control, and many of these can adversely affect endeavors to obtain optimal BG level management. For many patients with type 2 diabetes mellitus, the passage of time often results in a loss of responsiveness to medication and a greater difficulty in achieving desired target levels. Determining the barriers to achieving optimal BG level control is therefore important in enabling patients to do better in terms of improving diabetes control and thereby reducing risk of longer-term complications (33). The particular goal set for glucose control in individual patients is dependent on a number of factors (34).

DCCT conclusively established the efficacy of improved glycemic control in minimizing the incidence of certain complications in diabetes patients. The effective health cares provide must share that responsibility by

a) Assuring that the patient has knowledge and skill necessary for compliant behavior
b) Maintaining an awareness of the signs and symptoms of noncompliance
c) Helping the patient identify and remove obstacles to compliant behavior(4)

However, there are many variables that affected to the effectiveness of BG level control which these factors depend on each other. In the literature review of this existing study indicated some variable that were related to BG level control which mostly are risk factor of diabetes, socio-demographic factors, and patient factors as follow,

2.2.3.1 Socio-demographic Factors

Age

Age is the single most important variable influencing the prevalence of diabetes. Most epidemiological studies show that prevalence increases with age but may plateau or even decline in very old age groups. Data taken from the third National Health and Nutrition Examination found that peak prevalence rates for diabetes for

men of 21.1% in the 75 plus age group. The peak prevalence for women is 17.8% which occurs in the 60-74 age range.

WHO and IDF reported the 40-59 age groups currently have the greatest number of persons with diabetes. Available evidence from the DCCT, UKPDS and from observational studies in older diabetics suggests the value of tight glucose control in all diabetics. For clinicians, our results highlight the uncertainty about the net benefit of treatment for diabetes in the elderly.

Gender Distribution

WHO and IDF reported the estimates for both 2003 and 2025 showed a female predominance in the number of persons with diabetes. The female numbers were about 10% higher than for males (37).

Nangnoi and Aree (38) studied the relationship between BG levels with bio-social and health status of diabetes patients in Maharajnakonrajasrima hospital, Thailand showed that the percentage of female and male diabetes was 69 and 31%.

Natalie et al (39) was studied about how well controlled is our type 2 diabetic patients in 2002? An observational study in North and Central Trinidad and found that 132 patients comprise 39 males and 93 females. The poorly controlled female was 58.1%.

Marital status

Family support is associated with better adherence to diabetic regimens and glycemic control and is the strongest, most consistent predictor of adherence. However, including both spouses in individual dietary counseling sessions may offer opportunities to suggest sharing roles, building flexibility, establishing rules, and improving communication patterns that will inspire further cooperation by spouses.

Daisy and Lynne (40) studied by interviewed couples, first together and then separately, during the first year after diagnosis and 1 year later. They found that

understanding categories of marital adjustment to the diabetic diet may improve nutrition-based diabetes interventions. Dietary treatment of type 2 diabetes disrupts family routines, especially mealtime routines, which are fairly resistant to change.

Paula et al (41) studied the relationship between marital quality and diabetes outcomes was explored with participants in which elderly Medicare beneficiaries in underserved areas were randomized to a telemedicine intervention or usual care. The subjects (N = 134) completed marital quality measures at baseline, and baseline and 1-yr data were available including BG control. At baseline, higher marital stress correlated with poorer BG control. In prospective analyses, an interesting trend for intervention subjects was noted a trend for greater baseline marital satisfaction to predict improved 1-yr BG control.

Occupation

Occupation, a major socio-economic factor, may be a risk factor for type-2 diabetes. Occupation is an important determinant of physical activity in such societies. Teruo et al (42) compared DM incidence among four groups of white-collar workers in a follow-up study in 13,547 Japanese men. In conclusion, sales workers in Japan aged more than 40 years may have increased risk for DM (55.0 to 100.0%) independent of BMI, lifestyles and education, and manager/administrative workers aged more than 50 years may have increased risk (65.0%) due to their large BMI.

Education

WHO stated that “Education is a cornerstone of diabetes therapy and vital to the integration of the diabetes into society”. Education level was an important predictor of awareness. Awareness of DM amongst diabetics is very low, and mainly determined by their education levels (55). CDC found that diabetes is more prevalent in populations with lower education (48).

2.2.3.2 Patients Factors

Compliance for diabetes patients is of critical importance if the patient wishes to live a functional life. Although the value of strict compliance with all advice from health care providers is debatable, for some conditions compliance is of critical importance, and in fact can be a matter of life and death. One such condition is diabetes. Donald and Nancy (43) studied patient accounts for noncompliance with diabetes self-care regimens and physician compliance-gaining response. They mentioned to medical noncompliance is pervasive in health care. Studies typically show rates of noncompliance ranging from 38.0 to 75.0%, with higher rates being associated with longer-term, lifestyle-changing behaviors.

Duration of having DM

Duration of having DM was one of barrier to achieve BG control. Shorter duration of diabetes could better control than longer. Poorer BG control arises in longer duration of having DM. Duration of diabetes negatively impacted older patients and patients attending the clinics for longer periods were less likely to be well controlled. Therefore, attention should be given to longer duration of the disease in practicing self-care of diabetes (39). Tonny Jensen et al (36) showed in Type 2 diabetic patients, the mean age and diabetes duration of the patients were 49 and 20 years, respectively.

Adherence to visit DM Clinic

The study of Donald and Nancy (43) found that 74% had diabetes treatment-related appointments every 3 months while 14.0% had appointments once a month or more and 12% had appointments once or twice a year. The vast majority (95.0%) reported seeing the same physician at each appointment.

However, as the literature reports, diabetes patients as a group are largely nonadherent, with some studies finding that only 7.0% of patients surveyed were judged to be fully adherent with all aspects of their regimen. Because the onus of responsibility for diabetic patients' health is on the patients themselves, studying the various aspects of their accounts for noncompliance and the interrelations of these

accounts to the subsequent compliance-gaining strategies physicians use to redress the noncompliance would seem warranted. The interpersonal communication literature on accounts and explanations provides some guidance in how the patient–provider interaction can influence diabetes-patient motivational levels for compliance with their treatment regimens (43).

Regularity of Taking Medication

Factors associated with regular medication were female sex, older age, hypertension, dyslipidemia, self-perceived poor health, and longer duration of the disease, and nonsmokers. The longer duration of the disease remained significantly associated with regular medication, while higher income levels were negatively associated with regular medication. Those with hypertension or dyslipidemia tended to take medicine regularly. Patients also may not achieve glycemic goals because of their failure to fully adhere to lifestyle measures and pharmacologic treatment regimens (31).

In a survey 29 of 125 primary care physicians, patient nonadherence to nonpharmacologic and pharmacologic therapy and lack of patient motivation were cited as significant obstacles to achieving optimal diabetes care. A systematic review of adherence citing retrospective analyses showed that adherence to oral antidiabetic therapy ranged from 36.0% to 93.0% in patients remaining on treatment for 6 to 24 months.

Obesity, Bodyweight, and BMI

Obesity is one of the principal risk factors for type 2 diabetes. An excess of body fat, especially when concentrated within the abdomen, has a range of potentially harmful consequences. Overweight and obesity lead to adverse metabolic effects on BP, cholesterol, triglycerides and insulin resistance. Obesity and type 2 diabetes are causally linked. A higher percentage of the population with a body mass index > 30 kg/m2 is associated with a higher percentage of the population with diabetes.

The health care burden of diabetes is related to an increasing prevalence of obesity and overweight--2 key risk factors for the development of type 2 DM. The age adjusted prevalence of obesity (body mass index [BMI] >30 kg/m 2) was 30.5% in the National Health and Nutrition Examination Survey (NHANES, 1999-2000) compared with 22.9% in NHANES III (1988-1994; P < 0.001). The prevalence of overweight (BMI >25 kg/m 2) also increased significantly during this period, from 55.9% to 64.5% (P < 0.001) (44).

Kinori Kosaka et al (45) conclusion, we confirmed that lifestyle intervention designed to achieve and maintain ideal body weight (BMI <22 kg/m2) is an effective means of reducing incidence of type 2 diabetes in males with IGT detected in regular health-screening examinations. Reduction in the incidence by lifestyle intervention was successfully carried out in a clinical outpatient setting for diabetic patients. The incidence of diabetes was positively correlated and the improvement in glucose tolerance was negatively associated with the change in body weight.

Hypertension

HT is a common comorbidity of diabetes and contributes to an increased risk cerebrovascular disease, as well as microvascular complications such as retinopathy and nephropathy. The ADA has recommended that BP be maintained at <130/<80 mmHg in patients with diabetes with the use of lifestyle modification and, if necessary, pharmacologic therapy (44).

Ole Torffvit et al (22) reported a prospective study for 10 years was performed in 385 type 2 diabetic patients (diabetes diagnosis more than 30 years) attending a hospital-based outpatient clinic. This study shows that poor metabolic control is associated with development and high BP with progression of nephropathy in type 2 diabetic patients.

Weimar et al (15) evaluated BP control and other cardiovascular risk factors in diabetic patients, in a reference center for the treatment of HT. Patients with DM were studied. They were evaluated in the first and last visit, in terms of BP, BMI,

hypotensive drugs being used, glycemia, cholesterol, creatinine and potassium. There were 146 patients with a diagnosis of diabetes.

Diet

Diet is the corner stone for the management of diabetes. People with diabetes have the same nutritional needs as anyone else. Along with exercise and medications, nutrition is important for good diabetes control (46).

Potential for Primary Prevention of DM is complex dietary change. Low glycemic load, high fiber diet which contains adequate amounts of mono-unsaturated and omega-3 fats and lean protein can improve satiety and dietary thermo-genesis and decrease insulin resistance. Non-fat dairy products, soy foods, and a modest alcohol intake can also improve insulin sensitivity. Calorie-dense foods, especially in the form of highly processed carbohydrates (sugars and starches), have a disproportionate effect on insulin sensitivity and promote weight gain which further increases insulin resistance. Nutrients that have also been associated with worsening insulin sensitivity include trans-fat and saturated fats (15). A healthy diet - eating between three and five servings of fruit and vegetables a day and eating less sugar and saturated fats has been shown to be important in maintaining appropriate weight, and therefore a lower risk of type 2 diabetes (47).

Dietary modification and lifestyle intervention remain the initial mainstay treatment of type 2 diabetes. Because most patients with type 2 diabetes are overweight and have features of metabolic syndrome, weight reduction reduces insulin resistance and improves other cardiovascular risk factors. Early involvement of a dietitian with an interest in diabetes is important. It is accepted that energy intake and expenditure balance should be adjusted to achieve a normal BMI of 20–25 kg/m^2. In clinical practice, however, realistic and individual targets should be set for weight loss (30).

The study of Steven et al (48) assessed the clinical impact of lifestyle change education on chronic disease risk factors within a community, the Rockford, Illinois,

metropolitan area were setting. They found that the control group experienced comparatively small but significant improvements in health knowledge, systolic and diastolic blood pressure, glucose, and in some nutrition variables. For almost all variables, the intervention group showed significantly greater improvements. Therefore, this lifestyle modification program is an efficacious nutrition and physical activity intervention in the short term and has the potential to dramatically reduce the risks associated with common chronic diseases in the long term including DM.

Physical Activity

In general, the more active you are, the lower your blood sugar. Physical activity causes sugar to be transported to your cells, where it's used for energy, thereby lowering the levels in your blood. Aerobic exercises such as brisk walking, jogging or biking are especially good. But gardening, housework and even just being on your feet all day also can lower your blood sugar (23).

Increased physical activity, it is estimated that currently 60% of the world's populations do not do enough physical activity. Studies have shown that just 30 minutes of moderate exercise a day, three days a week, is enough to promote good health and reduce the chances of developing type 2 diabetes (47). Strength training (e.g. weight lifting) has been shown to improve all of the manifestations of the metabolic syndrome. Thus, increasing the utilization of glucose by either increasing muscle mass and/or increasing muscle sensitivity (i.e. aerobic exercise) is a highly effective means of improving glucose homeostasis (13)

Dietary and activity changes to produce a 5.0-7.0% weight loss can successfully reduce the incidence of type 2 diabetes; reductions in fat and calorie intake accompanied by half an hour's extra walking or other exercise each day have been demonstrated to lower the incidence by 58.0%. Great success has been achieved among people over 60 years, reducing the development of diabetes in that high-risk age group by 71.0% (49).

Exercise improves BG level control in type 2 diabetes. Generally, any exercise with a duration of 30 minutes is recommended to aid weight loss, accompanied by an appropriate diet. However, though a recent study confirmed that 30 minutes of moderate-intensity exercise on most days was associated with a reduction in BP, total cholesterol and triglyceride levels, 60–75 minutes was required to reduce weight, waist circumference, fasting glucose and low-density lipoprotein cholesterol, increase high-density lipoprotein and reduce overall 10-year cardiovascular risk (30).

Derouich and Boutayeb (50) conclude that the practice of a regular physical activity is recommended to diabetic and non-diabetic people. It is specially indicated to people at risk of diabetes and to NIDDM for whom it should be a part of the treatment since it improves insulin sensitivity, lowers the average blood glucose concentration and may improve weight reduction. Moreover, it is becoming clear that diabetes is sweeping the globe as a silent epidemic encouraged by decreasing levels of activity and increasing prevalence of obesity.

Cigarettes Smoking

People with diabetes are at greater risk of dying from coronary heart disease, stroke and peripheral vascular disease than people without the condition. Smoking increases the risk even further (47).

Understanding the impact of smoking on diabetes becomes critical in the management of diabetes patients. Based on enhanced mortality risks of smokers, the ‘‘glucose equivalent’’ of smoking will be developed. The application of ‘‘glucose equivalent’’ concept to the smoking diabetes may change the paradigm of diabetes management. Through communicating such a concept to the smoking patients, smoking cessation will become one of the most important therapeutic considerations, if not the most, for these patients (51).

Bjorn Eliasson (52) studied about Cigarette Smoking and Diabetes, in a cross-sectional study, compared insulin doses and related variables in diabetic patients treated with insulin rejections. In the 114 smokers insulin doses as well as serum

triglyceride levels were significantly higher than in the 163 nonsmokers, in a dose-dependent manner. A high number of clinical and experimental studies and surveys give strong support for significant associations between tobacco use, the development of diabetes, glycemic control, and diabetic complications (micro- and macrovascular). In diabetes care, smoking cessation is of utmost importance to facilitate glycemic control and limit the development of diabetic complications.

Alcohol Intake

Several lines of evidence suggest that risk for diabetes and glucose control in persons with diabetes are both associated with choice in beverages. Moderate alcohol consumption was associated with decreased risk for diabetes, whereas increased risk was linked to having four or more alcoholic drinks per day. Moderate intake of alcohol was associated with improved glucose control in men with type 2 diabetes.

Our finding that adults with diabetes who drank alcohol had better glucose control is supported by a small randomized controlled trial that found that acute alcohol consumption improved insulin action in persons with type 2 diabetes. A systematic review concluded that moderate intake of alcohol does not impair glucose control and suggested that it might improve control.

Long-term exposure to alcohol is associated with an improvement in insulin sensitivity. At this time, however, there is no definitive proof that alcohol per se has an effect on the insulin sensitivity index in type 2 diabetes patients.

Todd Mackenzie et al (53) studied about Beverage Intake, Diabetes, and Glucose Control of Adults in America. The aim of the study was to examine the association between type of beverages consumed and glucose control in American adults with and without diabetes. They found that subjects who had 30 or more drinks per month of alcohol had mean HbA1c levels 1.2 units less ($p< 0.001$) in persons with diabetes. In the conclusion was alcohol consumption, at least in moderate amounts, correlates with better glucose control.

In summary, WHO and IDF Studies have shown that many complications of diabetes can be prevented or delayed through effective management. This includes lifestyle measures such as a healthy diet, physical actively, the avoidance of overweight and obesity, and not smoking. Preventative care need not involve costly treatment or medication. Education in good foot care as well as regular inspection is a good example of a low cost method of prevention.

Diabetes therapy is not only about lowering glucose, but also about the overall reduction in the risk factors for diabetic complications, which includes the control of BP and blood lipids. This requires lifelong care and management.

In order to prevent or delay complications, people with diabetes may have to modify their lifestyle. People with type 2 diabetes often require oral drugs, and sometimes insulin to control their blood glucose levels (47).

CHAPTER 3
RESEARCH METHODOLOGY

This research studied determining factors of the effectiveness of blood glucose level control among diabetes patients in Maeprik District, Lampang Province, Thailand in the fiscal year 2005. The research process was as follow:

3.1 Research Design
3.2 Study Population
3.3 Sampling Frame and Sampling Technique
3.4 Sample Size Determination
3.5 Study Site
3.6 Research Instrument
3.7 Reliability and Validity
3.8 Procedure of Data Collection
3.9 Data Analysis Procedure

3.1 Research Design

The research design was the cross-sectional study.

3.2 Study Population

Population in this study was all of diabetes patients who registered and attended to DM clinic in all Maeprik health delivery services at least 1 year. The numbers of registered diabetes patients in fiscal year 2005 were 389.

3.3 Sampling Frame and Sampling Technique

From October 2005 to September 2006, the number of diabetes patients of Maeprik district was 389. Morbidity rate of DM was 2.7%. The patients were

randomly selected by simple random sampling and every possible sample has the same probability of being selected according to the calculated sample size of the study population using the formula as follow;

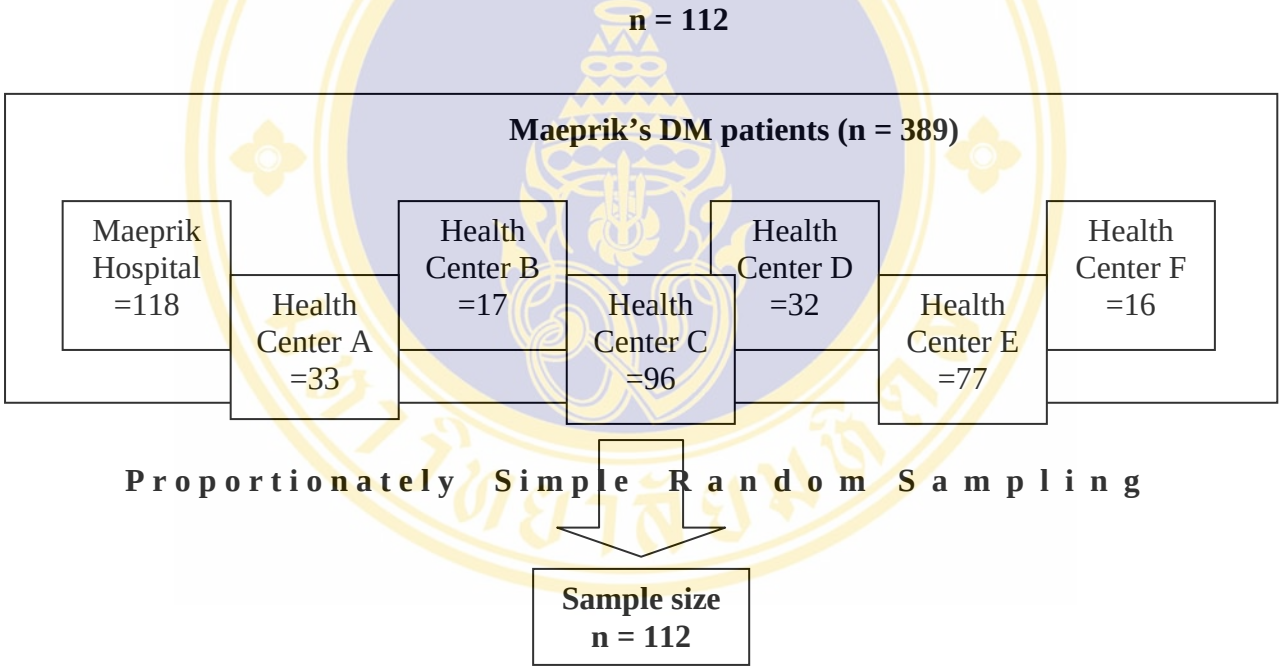
$$\mathbf{n = (Z^2\ P\ (1\text{-}P))/\ E^2}$$

n = Estimated sample size,

Z = the standard normal deviation, set at 1.96 which corresponds to the 95% confidence level, Z = 1.96**,**

P = proportion of diabetes morbidity, P = 0.027,

E = the error or Degree of accuracy desired setting, E = 0.03.



Maeprik Hospital,

Health center A: Mae Chaengrai Lum Health Center,

Health center B: Mae Chaengrai Bon Health Center,

Health center C: Thon-Tong Health Center,

Health center D: Phapung Health Center,

Health center E: Mae-Pu Health Center, and

Health center F: Huay-Kee-Nok Health Center.

Figure 6 Flow Chart of Sampling Frame and Sampling Technique

3.4 Sample Size Determination

From proportionately simple random sampling formula as above, there were 112 samples from of 389 diabetes patients in Maeprik District. However, the research undertook to collected data as much as possible and at least 112 samples. In this study got 129 samples. The proportionately sample calculated as below;

Number of proportionately sample in each health service
= (Number of Registered diabetes/ Total register diabetes) * Number of sample size

Maeprik Hospital;	(118/389)*112 =	35 sample,
Health Center A;	(33/389)*112 =	10 sample,
Health Center B;	(17/389)*112 =	4 sample,
Health Center C;	(96/389)*112 =	27 sample,
Health Center D;	(32/389)*112 =	10 sample,
Health Center E;	(77/389)*112 =	22 sample,
Health Center F;	(16/389)*112 =	4 sample,

3.5 Study Site

This study was done in Maeprik District, Lampang Province, Thailand.

3.6 Research Instrument

The instrument for data collection was a structured questionnaire design by the researcher. The questionnaire divided into 4 parts as follow:

Part 1 – Socio- demographic Factors

Part 2 – Patient Factors

Part 3 – Knowledge about DM

Part 4 – Monthly Patients' Blood Glucose Level Record

The data in Part 1-3 was primary data and collected the current data in January 2007 because the researcher believed that the patients' behavior didn't change

abruptly. For Part 4 utilized monthly BG level value among the previous 1 year from individual patient's diabetes manual and the medical record file of health services.

Part 1: Socio- demographic Factors

This part was respondent's characteristic that independent variables consist of age groups, gender, marital status, education, and occupation. All variable were measured frequency and percentage. Central tendency and dispersion measured only age group variable.

Part 2: Patient Factors

This study concerned 9 factors of patients in term of duration of having diabetes, adherence to visit DM clinic, regularity of taking medication, HT, BMI, diet control status, physical activity status, cigarette smoking and alcoholic consumption. These factors associated with patient's exiting behaviors in term of risk, compliance and the current conditions which it corresponded to the recent awareness and the accomplishment of patients. For diet control and physical activity status evaluate from the set of questions about the patients' behavior in the last week.

The assessments based on the patient's right answer of both diet control (rice and food intake) and physical activity behaviors (duration and frequency of exercise). The appropriate diet control status means the patients ought to have both rice and food appropriately. For the proper physical activity, the patients had to have the proper duration and frequency of the exercise.

The appropriate diets of this study were steamed or boiled rice, food with the saturated fat, fiber diet including vegetable and fruit. Diabetes patients should avoid sticky rice, food with the saturated fat, sugar, and curry soup with coconut milk.

For proper exercise, more than 30 minute at least three times weekly.

All data collection was collected by interviewer at the present in January 2007, some data got from the health services medical record file and the individual patient's

diabetes manual such as duration of being diabetes, adherence to visit DM clinic and patients' BG level data. Frequency distribution applied for all variables. The quantitative data were age, BMI and BG level that measures central tendency and dispersion; frequencies, percentage, mean and standard deviation.

Part 3: Knowledge about DM

This part was the evaluation of the level of knowledge about DM of patients according to 20 general DM knowledge questions such as definition, sign and symptom, its complications and prevention, DM management, and diabetes control. The test drawn in agree, disagree or undecided answer. Scoring system was set as "1" for correct answer and "0" for wrong and undecided answer, and then the total scores were calculated for each respondent. The total score was 20. Then frequency and percentage of each level were obtained as well as the mean and standard variation taken as a whole.

Part 4: Monthly Patients' Blood Glucose Level Record

This part was recorded BG level monthly from October 2005 to September 2006. The assessment of the effectiveness of BG level control of diabetes patients evaluated from the mean of all the BG level results, in a one year period. This study was classified into 2 levels; *good* and *poor control*.

3.7 Reliability and Validity

The questionnaire was pretested among 20 diabetes patients in DM clinic and revise accordingly before use for formal testing. The researcher supervised and discussed everyday with interviewers about problems that the interviewers encountered during interview. At the end of each day, the data was checked by the researcher to avoid the errors and missing answers. These errors were elaborated and corrected.

After testing 20 diabetes patients, data were entered into Minitab program for processing and analysis of the knowledge part by The Kuder-Richardson Formula 20 (KR 20). The result of reliability test for KR 20 was 0.7398.

3.8 Procedure of Data Collection

The research process was begun with a presentation to the Executive Chief of Lampang Provincial Health Office, the Head of Maeprik District Health Office and the Director of Maeprik Community Hospital, respectively. The researcher contacted the health personnel who were responsive for DM clinic in all health services and asked for the health personnel interviewers. The researcher instructed and guided them what to do and how to collect before functioning. The questionnaire interviewed outpatients at the time of hospital's visit and patients' residence. Some question got from the health services medical record file and the individual patient's diabetes manual. The duration for each case interviewing ranged from 15-20 minutes. Immediate control of the completed questionnaire reduced the occurrence of missing data. All the data were processed to prevent mistake as much as possible. Duration of data collection was approximately 20 days in January 2007.

3.9 Data Analysis Procedure

Data entry and data analysis was done by using Minitab. Frequency distribution applied for all variables. Age groups, BMI, and the effectiveness of BG level control of diabetes patients measured by central tendency and dispersion; frequencies, percentage, mean, SD, minimum and maximum.

Chi-square test was used for describing the relationship between independent variables and the effectiveness of control in BG level of diabetes patients.

CHAPTER 4
RESULTS

All 129 diabetes patients of Maeprik district, Lampang province were interviewed by health team of Maeprik hospital from January 5th to 20th, 2007. All of interviewers were well-trained by researcher before interviewed their target groups. When interviewers submitted questionnaire, all details in each questionnaire were checked and examined carefully without any missing.

The results of the study were presented into 2 parts as follows:

Part 1: Descriptive Part

Characteristics of variable

1) Socio-demographic Characteristics
2) Patient Characteristics
3) Knowledge about DM of the Respondents
4) Blood Glucose Level Control of Diabetes Patients

Part 2: Analytical Part

The Association between Dependent variable and Independent variables

1) The Association between Blood Glucose Level Control and Socio-demographic Characteristics
2) The Association between Blood Glucose Level Control and Patient Characteristics
3) The Association between Blood Glucose Level Control and Knowledge about DM

For descriptive part, the data described the characteristics of independent variable by frequency and percentage of respondents.

For analytical part, the relationship of dependent variable and individual average blood glucose level control of diabetes patients were demonstrated by chi-square test.

Part 1 Descriptive Part

Characteristics of variable

1) Socio-demographic Characteristics

Socio-demographic characteristics were identified by age groups, gender, marital status, occupation and educational level of the diabetes patients. The distributions of these characteristics were presented in the Table 7.

Age of diabetes patients was wide range among 34 to 87 years old. The majority of respondents (34.9%) were 50-59 years. One fourth of the respondents were 60-69 years. Only 3.9% were older than eighty years. Mean of age was 59.0 and standard deviation was 11.8.

Female respondents (62.8%) were more than male respondents (37.2%). The proportion of female to male was nearly two times.

This study found that three fourths of subjects were married, followed by the widow and single accounting for 15.5 and 8.5% respectively. There was no divorce or other marital status.

One half of diabetes patients were farmer and agricultures, while 31.0% were unemployed. Civil servants, laborers and merchants had only 7.8, 6.1 and 3.9%, respectively. Other occupation was 1 monk and 1 housewife.

The educational level indicated that almost all respondents (80.6%) had finished primary educational status. The minority of respondents had received secondary (7.8%) and higher than secondary level education (6.2%), respectively. Only 5.4% of the respondents were illiterate.

Table 7 Socio-Demographic Characteristics of the Respondents

Characteristics			Number (N=129)	Percentage
Age groups				
34 - 49			26	20.1
50 - 59			45	34.9
60 - 69			31	24.0
70 - 79			22	17.1
80 - 87			5	3.9
Mean = 59.0	SD = 11.8	Min = 34.0	Max = 87.0	
Gender				
Male			48	37.2
Female			81	62.8
Marital status				
Single			11	8.5
Married			98	76.0
Widow			20	15.5
Occupation				
Farmer and Agriculture			64	49.6
Laborer			8	6.1
Merchant			5	3.9
Civil servant			10	7.8
Unemployed			40	31.0
Other			2	1.6
Educational level				
Illiterate			7	5.4
Primary school			104	80.6
Secondary school			10	7.8
Higher than secondary school			8	6.2

2) Patient Factors

Patient factors were identified by duration of having DM, adherence to visit DM clinic, regularity of taking medication, BMI, HT status, diet control status, physical activity status, cigarette smoking and alcoholic consumption. The distribution and details of these characteristics were presented in the Table 8. For the results of diet control status and physical activity were patients' behavior, the researcher had assessed by performance of the respondents' actual activity in the previous week and had interpreted it by using diet and physical behavioral criteria of this study as shown in operational definition in chapter 1.

The number of diabetes cases was decreasing as the duration of having DM increased. About one half of the respondents had the duration of having DM less than five years. 37.2% of the respondents had a 5-10 year period of having DM. Only 4.6% of the respondents had 16-20 years period.

Regarding the adherence to visit DM clinic in fiscal year 2005, respondents had good adherence (79.1%) some more than fair (12.4%) and a few were poor (8.5%). In addition to take DM medication, the majority of subjects had taken medication regularly (84.5%).

For BMI, this study considered the criteria of APPRO year 2000. It found that about one fourth was overweight and about one third of the respondents were obese. There was 18.6% of respondent having normal BMI, and 19.4% of respondent were underweight. The range of BMI was 16.9 to 32.4. The characteristic of major co-morbidity of DM, HT was presented in this study. The result showed rare or less differed of present and absent HT. It found that 43.4% of diabetes clients had HT co-morbidity.

Both cigarette smoking and alcoholic consumption seemed similar in results. Up to 84.5% of respondents weren't smoking as well as 88.4% of respondents didn't drink alcohol. Only 6.2% of the respondents had frequency smoking. The non-alcohol respondents was 2.3%.

Table 8 Patient Characteristics

Characteristics	Number (N=129)	Percentage
Duration of having DM (Yrs)		
< 5	61	47.3
5 – 10	48	37.2
11– 15	14	10.9
16– 20	6	4.6
Adherence to visit DM clinic		
Good (No missing)	102	79.1
Fair (1 missing)	16	12.4
Poor (> 1 missing)	11	8.5
Regularity of taking medication		
Regular	109	84.5
Irregular	20	15.5
BMI		
Underweight	25	19.4
Normal	24	18.6
Overweight	34	26.4
Obese level 1	43	33.3
Obese level 2	3	2.3
Mean = 23.6 SD = 3.5 Min = 16.9 Max = 32.4		
Hypertension status		
Present	56	43.4
Absent	73	56.6
Diet control status		
Appropriate	60	46.5
Inappropriate	69	53.5
Physical activity		
Proper	3	2.3
Improper	126	97.7
Cigarette smoking		
Frequency	12	9.3
Sometimes	8	6.2
Never	109	84.5
Alcoholic consumption		
Frequency	3	2.3
Sometimes	12	9.3
Never	114	88.4

The assessment of diet control status depended on the respondents' eating behavior. The respondents had to have the appropriate of rice and food intake, the results will be the appropriate diet control status. This study, all respondents had the proper behavior of taking food alternative. Nevertheless, only 46.5% of the respondents had the appropriated rice taking. Therefore, diet control status based on rice intake and only 46.5% of the respondents had the appropriated diet control status as shown in Table 9.

Table 9 Diet Control Status Assessment

Characteristics	Number (N=129)	Percentage
Diet control status		
Rice intake		
Appropriate	60	46.5
Inappropriate	69	53.5
Food intake		
Appropriate	129	100.0
Inappropriate	0	0.0
Diet control status assessment		
Appropriate	60	46.5
Inappropriate	69	53.5

Almost the respondents had improper physical activity (97.7%). In this case, the assessment of physical activity was based on duration of exercise. Even though the proportion of the proper to improper in exercise frequency of respondents was nearly one half each but the respondents who had the proper duration of the exercise been only 2.3%. The detail showed in Table 10.

Table 10 Physical Activity Assessment

Characteristics	Number (N=129)	Percentage
Physical activity		
Frequency of exercise		
Proper	69	53.5
Improper	60	46.5
Duration of exercise		
Proper	3	2.3
Improper	126	97.7
Physical activity assessment		
Proper	3	2.3
Improper	126	97.7

3) Knowledge about DM

This part demonstrate patient's knowledge about DM including sign and symptoms, risk factors, complications, treatment, diabetes monitoring, diseases prevention and health promotion. The total knowledge score of the respondents were gathered and it was categorized into two groups. If respondents got 17-20 scores (above 80.0%), it was considered good. If they obtained correct scores between 12- 16 (60.0-80.0%), it indicates fair level of knowledge. If the respondents got less than 12 scores, it means poor knowledge.

In this study, it was found that the respondents with good knowledge (48.8%) were nearly more equal proportion than fair (47.3%). Only 3.88% of the respondents got poor knowledge about DM. The mean was 16.2, and SD was 2.3. The minimum score was 10 whereas the maximum score was 20. The results were shown as shown in the Table 11.

Table 11 Knowledge about DM of the Respondents

Characteristics		Number (N=129)	Percentage
Knowledge			
Good (> 80.0 %)		63	48.8
Fair (60.0-80.0%)		61	47.3
Poor (< 60.0%)		5	3.9
Mean=16.2	SD = 2.3	Min = 10.0	Max = 20.0

Regarding details of the respondents' knowledge about DM, it could group the answer according to definition (Question 1), sign& symptom (Question 4), complication of diabetes (Question 2,7-9,11), precaution (Question 10), and diabetes care/control/management (Question 3,5,6,12-20).

The result showed that the majority of the respondents knew very well about definition (94.0%), sign & symptom of DM (98.4%), precaution in alcohol control (94.6%) and their self-responsibility (98.4%).

The knowledge of diet control and exercise also knew fair to well, and their percentage was 86.8% to 97.7%. About DM complication, the respondents also knew very well including foot care (100.0%), eye problem and neuropathy (98.4%), except the effect to heart disease (42.6%) and renal problem (60.5%). It found that the knowledge of BG monitoring was fair both question 6 (72.1%) and 15 (72.9%). However, the respondents got poor about the knowledge of treatment, only 17.1% and 39.5% of correct answer in question 12, 13 which asked about medication. More details are shown in Table 12.

Table 12 Correct Answer of Knowledge about DM of the Respondents

Statement	Correct answer	
	No.	%
1. Diabetes is a group of diseases marked by high BG level.	121	94.0
2. DM can lead to serious complications and premature death.	127	98.4
3. Diabetes patients can adjust anti-diabetic medication by themselves.	103	79.8
4. Frequent urination is one of diabetes symptom.	127	98.4
5. Foot care is important for diabetes patients. If your feet got wound, you should early visit hospital.	129	100.0
6. BG monitoring is not a key part of the DM treatment program.	93	72.1
7. Diabetes is not attributed to heart disease.	55	42.6
8. Poorly-controlled diabetes can lead to blindness.	127	98.4
9. Diabetes can leading to peripheral neuropathy.	127	98.4
10. Diabetes patient should avoid alcohol drinking.	122	94.6
11. High blood sugars can not be cause of renal problems.	78	60.5
12. The first line treatment of diabetes is taking medication.	22	17.1
13. All diabetes patients are initiated by taking an oral medication.	51	39.5
14. People with diabetes must take responsibility for their day-to-day care.	127	98.4
15. BP and cholesterol level is not necessary to control in diabetes patients.	94	72.9
16. Vegetable and fruit are suitable food for diabetes patients.	126	97.7
17. Food cooking with saturated oil is better than unsaturated oil.	112	86.8
18. If we go walking everyday and more than 30 minutes each, it is sufficient for diabetes patients.	125	96.9
19. If we go running 45 minutes per day and 3 days per week, it is sufficient for diabetes patients.	113	87.6
20. If your FBS is 200 mg/dl, it means good control.	106	82.2

4) Blood Glucose Level Control of Diabetes Patients

The patients were categorized into two groups: well controlled, when fasting blood sugar (FBS) level ≤ 120 mg/dl and poorly controlled, when FBS level > 120 mg/dl. The mean of monthly BG level in each respondent by the fiscal year 2005 was collected. The mean was 133.0 and standard deviation was 29.01. The minimum blood glucose level was 88.0, while the maximum blood glucose level was 270.0. The result showed about two-thirds (62.02%) blood glucose level of respondents had poorly controlled as shown in Table 13.

Table 13 Blood Glucose Level Control of the Respondents

Characteristics	Number (N=129)	Percentage
Blood glucose level control		
Good (≤120 mg/dl)	49	38.0
Poor (>120 mg/dl)	80	62.0
Mean=133.0 SD = 29.1	Min = 88.0	Max = 270.0

Part 2: Analytical Part

The Association between Dependent and Independent Variables

In order to accomplish the inferential statistic by Chi-square test, the researcher had to regrouping of some factors for analytic data as shown in Table 14– 16.

1) The Association between Blood Glucose Level Control and Socio-demographic Characteristics

Socio-demographic characteristics consist of age groups, gender, marital status, occupation and education. The BG level control was classified into two groups; good and poor control. The numbers of respondents in good and poor BG level control were respectively 49 and 80. The association between BG level and socio-demographic characteristics of respondents as showed in Table 14.

Table 14 The Association between Blood Glucose Level Control and Socio-demographic Characteristics

Characteristics	Good control		Poor control		χ^2 (df)	*p* value
	No.	%	No.	%		
Age groups						**0.204**
34 – 49	6	23.1	20	76.9	3.18 (2)	
50 – 59	18	40.0	27	60.0		
60 – 84	25	43.1	33	56.9		
Mean = 59.0	SD = 11.8		Min = 34.0		Max = 87.0	
Gender						**0.507**
Male	20	41.7	28	58.3	0.44 (1)	
Female	29	35.8	52	64.2		
Marital status						**0.708**
Single	4	36.4	7	63.6	0.69 (2)	
Married	39	39.8	59	60.2		
Widow	6	30.0	14	70.0		
Occupation						**0.698**
Farmer and Agriculture	26	40.6	38	59.4	1.44 (2)	
Unemployed	16	38.1	26	61.9		
Others	7	30.4	16	69.6		
Educational level						**0.137**
Illiterate and primary school	45	40.5	66	59.5	0.05 (1)	
Secondary school and higher	4	22.2	14	77.8		

The Association between Blood Glucose Level Control and Age Groups

The proportion of poor control was higher than good control in all age groups. In youngest age group the proportion of poorly controlled is about 3 times more than those who had well controlled but as the age increases the trend decreases. However, there was no significant difference among age groups (*p*-value = 0.204).

The Association between Blood Glucose Level Control and Gender

Around 60.0% of both genders were poor BG control. Accordingly male was higher proportion of well controlled (41.7%) than female (35.8%). However, BG level control was no significantly associated with gender (*p*-value = 0.507).

The Association between Blood Glucose Level Control and Marital status

About 40.0% of single and married had good BG level control, while widowed was only 30.0%. Nevertheless, the association was not found significantly (*p*-value = 0.708).

The Association between Blood Glucose Level Control and Occupation

The proportion of poor BG level control was higher than good control in all occupation. Poorly controlled were 60.0% or above in all occupation groups. However, there was no significant difference among occupation (*p*-value = 0.698).

The Association between BG Level Control and Educational status

The majority of respondents were illiterate and primary educational status. Considering good control, the illiterate and primary educational group was higher than the secondary or higher educational group. However, more than one half (59.5%) of illiterate and primary educational group had poorly controlled whereas more than third fourths (77.8%) of secondary or higher educational group had poorly controlled. The data revealed that level of significance was inconsistent (*p*-value = 0.137).

The pattern in each category of socio-demographic characteristics seemed to be corresponded to the total distribution except in age group and gender where the oldest age group and male gender showed slightly different pattern. However, it concluded that there was no significantly association between in any socio-demographic characteristic and BG level control.

2) The Association between BG Level Control and Patient Characteristics

Mostly there was no associated significantly between BG level control and patient characteristics (*p*- value > 0.050). This study concluded that BG level control were statistically significant associated with the taking medication regularly (*p*-value = 0.027) and cigarette smoking (*p*-value = 0.027) as shown in Table 13.

The Association between BG Level Control and Duration of having DM

The longer duration of having DM, the poorer BG level control (59.0% for < 5 years, 60.4% for 5-10 years and 75.0% for 11-20 years). However, BG level was no significantly associated with duration of having DM (*p*- value = 0.424).

The Association between BG Level Control and Adherence to visit DM Clinic

The respondents who had more adherences to visit DM clinic were better control or vise versa. Considering good control, it found that 39.2% of the respondents had good adherence, 37.5% of the respondents had fair adherence and only 27.3% in poor group. However, the association was not found significantly (*p*- value = 0.740).

The Association between BG Level Control and Regularity of Taking Medication

According to medical taking among regular taking group the proportion of poor BG level control is twice as much as good control but for irregular group the proportion of good control is high. Only one third of those who had regularly taking medication showed good BG level control while 60.0% of irregular group were well controlled. Although it was contradictory shown that the significant statistically association of BG level control and the regularity of taking medication (*p*- value = 0.027), there was the reverse association.

The Association between Blood Glucose Level Control and BMI

The weight was increasing the trend of BG level control was decreasing. 48.0% of underweight respondents could achieve good BG level control while those who had obese level 1 could reach good control only 16.3% and 0% in obese level 2. Around 60.0% of both groups who had normal and overweight were poorly controlled. Nevertheless the association was not found to be significant (*p*- value = 0.530).

Table 15 The Association between BG Level Control and Patient Characteristics

Characteristics	Good control		Poor control		χ^2 (df)	*p* value
	No.	%	No.	%		
Duration of having DM (Yrs)						**0.424**
< 5	25	41.0	36	59.0	1.97 (3)	
5 – 10	19	39.6	29	60.4		
11 – 20	5	25.0	15	75.0		
Adherence to visit DM Clinic						**0.740**
Good (No missing)	40	39.2	62	60.8	0.60 (2)	
Fair (1 missing)	6	37.5	10	62.5		
Poor (> 1 missing)	3	27.3	8	72.7		
Regularity of Taking Medication					4.87 (1)	**0.027***
Regular	37	33.9	72	66.1		
Irregular	12	60.0	8	40.0		
BMI						**0.544**
Underweight	12	48.0	13	52.0		
Normal	9	37.5	15	62.5	3.08 (4)	
Overweight	13	38.2	21	61.8		
Obese level 1	15	16.3	28	83.7		
Obese level 2	0	0.0	3	100.0		
Mean = 23.6	SD = 3.5		Min = 16.9		Max = 32.4	
Hypertension Status					1.43 (1)	**0.231**
Present	18	32.1	38	67.9		
Absent	31	42.5	42	57.5		
Diet Control Status					0.08 (1)	**0.774**
Appropriate	22	36.7	38	63.3		
Inappropriate	27	39.1	42	60.9		
Physical Activity					1.88 (1)	**0.228****
Proper	0	0.0	3	100.0		
Improper	49	38.9	77	61.1		
Cigarette Smoking					4.87 (1)	**0.027***
Smoking	12	60.0	8	40.0		
Non-smoking	37	33.9	72	66.1		
Alcoholic Consumption					0.16 (1)	**0.693**
Alcoholic drinking	5	33.3	10	66.7		
Non-drinking	44	38.6	70	61.4		

* significant at *p*-value < 0.05, ** = fisher exact test

The Association between Blood Glucose Level Control and HT Status

The respondents without HT were better control than those who had HT. Regarding good BG level control only 32.1% of respondents with HT had whereas those who without HT were 42.5%. This finding found that BG level control was not shown any significantly associated with HT co-morbidity *(p*- value = 0.231).

The Association between BG Level Control and Diet Control Status

The proportion of appropriate and inappropriate diet control among the respondent were approximately equal and the distribution of BG level control were not much differed for both groups. However, the association was not found significantly (*p*-value = 0.774).

The Association between BG Level Control and Physical Activity

The majority of respondents were improper physical activity and 61.1% of those who had improper physical activity were poor BG level control. Since almost all of the respondents had improper physical activity, therefore the BG level was not so good. Nevertheless, this association was found to be of no significance (*p*-value = 0.288).

The Association between BG Level Control and Cigarette Smoking

The proportion of the smoking and non-smoking respondents were nearly twice for good control. Two thirds of non-smoking respondents had poorly controlled while 60.0% of the smoking respondents had well controlled. However, it was paradoxical shown that the significant statistically association of BG level control and cigarette smoking (*p*- value = 0.027).

The Association between BG Level Control and Alcoholic Consumption

The proportion of alcohol drinking and non-drinking among the respondent were approximately equal and the distribution of BG level control were not much differed for both groups. About two thirds of both groups had poor BG level control. However, the association was not found significantly (*p*-value = 0.693).

3) The Association between BG Level Control and Knowledge about DM

The proportion of good and fair/poor knowledge about DM was rare or less the same (49.0 vs. 51.0%) but the percentage of BG level control among fair/poor groups was noticing higher than the good one (42.4 vs. 33.3%). However, this association was found to be of no significance (*p*-value = 0.991) as showed in Table 14.

Table 16 The Association between BG Level Control and Knowledge

Characteristics	Good control		Poor control		χ_2 (df)	*p* value
	No.	%	No.	%		
Knowledge					1.04 (2)	**0.288**
Good (> 80 %)	21	33.3	42	66.7		
Fair/Poor (<80%)	28	42.4	38	57.6		
Mean=16.2	SD = 2.3		Min = 10.0		Max = 20.0	

CHAPTER 5
DISCUSSION

The cross-sectional study was designed to identify determining factors of the effectiveness of blood glucose level control among diabetes patients in Maeprik District in fiscal year 2005. All 129 diabetes patients of Maeprik district, Lampang province were interviewed. This study focused on the socio-demographic factors, patient factors and knowledge as independent variables.

Based on HBM, there are many modify factors relate to BG level control including socio-demographic variables (i.e. age, gender etc), structural variables (i.e. knowledge about DM). Many patients try to adjust their preventive behavior and lifestyles for overcome perceived barriers of the factors and BG level control. It conducted to patient's compliance in follow-up BG level. However, their performance were divergence depend on individual awareness.

5.1 The Effectiveness of Blood Glucose Level Control among Diabetes Patients

In a worldwide phenomenon as in spite of current therapies more than 60% of Americans with diabetes have poor BG level control. Corresponded to the intensive therapy investigators from UKPDS that reported BG level control deteriorates over time by intensive therapy investigators (55), this study found that about two thirds was poorly controlled. The mean of blood glucose level was 133.0 mg/dl.

The Caribbean Health Research Council (CHRC) developed guidelines to control several factors that are fundamental to the management of diabetes in primary care. One of management plans for patients with diabetes should include steps to achieve glycemic control. The result of this study showed only 37.0% of the respondents had well controlled which supported Natalie's study that the vast of patients were poorly controlled (55.3%) (39).

5.2 The Effectiveness of Blood Glucose Level Control among Diabetes Patients related with Socio-demographic Factors

The pattern in each category of socio-demographic characteristics seemed to be corresponded to the total distribution except in age group and gender where the oldest age group and male gender showed slightly different pattern.

However, the results of this study showed that BG level control was not significantly related with all socio-demographic factors. Corresponded to the study of Nangnoi and Aree (38) that demonstrated each element of bio-social and health status didn't show significantly relationship with BG levels.

5.2.1 Age and Blood Glucose Level Control

This study was categorized age into three groups including less than 50, 50-59 and 60 or above as Table 14. The trend of diabetes frequency was increasing with the higher age groups; 20.1, 34.9 and 45.0% respectively. The mean age was 59.0 and standard deviation was 11.8. This finding supported the study of Natalie et al (39) with 132 patients that found the mean age of the study sample was 58.4 years and standard deviation was 10.2. Poorly controlled was higher than well controlled in all groups. The percentage of poorly controlled among age groups was 70.9, 60.0 and 56.9%, respectively. However, the relationship was not found statistically significant confirmed the study of Nangnoi and Aree (38) that found BG level shown no significantly association with age.

This study also described that increasing age of the subjects showed increasing proportions of good BG level control. It was further demonstrated that older patients had better control when compared with the younger patients. The old age didn't seem to be barriers to achieving BG level control.

5.2.2 Gender and Blood Glucose Level Control

This study found that female respondents had number of diabetes higher than male. The proportion of female to male was nearly two times. Female who had

poorly controlled was high (64.2%) which supported WHO and IDF reported that showed a female predominance in the number of diabetes (37). Corresponded to the study of Natalie (39) that described 132 patients comprise 39 males and 93 females. The poorly controlled female was 58.1%. The study shown that BG level control was no significantly associated with gender (*p*-value 0.171) confirmed this study was not found significantly of the association as well as Ramachandran's study (54) pointed that women had a slightly higher prevalence of diabetes than men, although the difference was not statistically significant (*p*-value = 0.115).

5.2.3 Marital status and Blood Glucose Level Control

Marital status indicate family support which is associated with better adherence to diabetic regimens and glycemic control, and is the strongest which it is the most consistent predictor of adherence. This study found that three fourths of subjects were married. All marital status had poorly controlled more than well controlled. Most of married were poorly controlled (60.2%). The association was not found significant. Similar to the study of Nangnoi and Aree (38) showed that the percentage of married were 78.1%. They also found that there was no significant difference (*p*-value = 0.59). Paula et al (41) described that higher marital stress correlated with poorer BG level control and a trend for greater baseline marital satisfaction used to predict improved 1-yr BG level control.

5.2.4 Occupation and Blood Glucose Level Control

One half of diabetes patients were farmer and agricultures, while one thirds were unemployed. The proportion of poor BG level control was higher than good BG level control in every occupational group. The farmer and agriculture groups who had well controlled were 40.6%, 38.1% of unemployed and 30.4% of other occupations. This study demonstrated that the association was not found significantly. This finding was supported by the study of Nangnoi and Aree (38) who found that BG level was not shown significantly associated with occupation (*p*-value = 0.87). However, Murugesan et al (54) clarified that higher occupation were significantly associated with better awareness (*p*-value < 0.0001).

5.2.5 Education and Blood Glucose Level Control

WHO stated that “Education is a cornerstone of diabetes therapy and vital to the integration of the diabetes into society”. This study revealed that the majority of respondents were illiterate and primary educational status (86.1%). Relatively correspond to the study of Hsing-Yi Chang (31), it found that 31.00% of them did not have formal education, and 38.0% went to elementary school. This study also found that the numbers of well controlled patients among illiterate and primary educational status were 10 times higher than that of secondary or higher status.

Regarding poorly controlled, this study found that nearly 60.0% of illiterate and primary educational status was poorly controlled while secondary and higher group were 81.8%. Conversely, the data revealed that BG level control was no significantly associated with educational level. This study supported by CDC, Georgia Atlanta, which found that diabetes was more prevalent in populations with lower education (48). Whereas Hsing-Yi Chang et al (31) mentioned that education level was mildly associated with self-care behaviors.

Education level was an important predictor of awareness. Awareness of DM amongst diabetics is very low, and mainly determined by their education levels (55). However, education may not be the major determinant in improving diabetic control. Other elements, such as behavior modification in comprehensive diabetic care programs, may be of greater importance in producing improved outcomes (56).

5.3 The Effectiveness of Blood Glucose Level Control among Diabetes Patients related with Patient Factors

Important components of diabetes management are an active role of the patient: diet, smoking habits, physical exercise and self-care behavior often need to change. Self-care behaviors included the following activities: taking medicine regularly, reducing weight, avoiding cigarettes or alcohol, exercising, practicing diet control, and maintaining a regular life style. The considered factors were demographic factors including age, sex, education, and income and health behavior factors including

smoking, drinking alcohol, and health conditions such as existence of other chronic diseases, limitation of activity of daily living and self-perceived health. In addition, the patient has to adhere to life long medical therapy (31).

The results of this study shown that blood glucose control was statistically significant related with the regularity of taking medication (*p*- value = 0.027) and cigarette smoking (*p*- value = 0.027). However, the other factors didn't shown significantly associated with blood sugar control.

5.3.1 Duration of having DM and Blood Glucose Level Control

Patients attending the clinics for longer periods were less likely to be well controlled. This finding found that nearly one half of respondents had the duration of having DM less than five years and only 15.5% had 11-20 years period. Considering poor control it showed that about 60.0% of respondents had both less than 5 and 5-10 years period whereas three fourths of the respondents had 11-20 years period. Corresponded to Natalie's study that found 45.0% of patients were having DM less than five years and 49.2% had well controlled (39). However, the association were not found significantly in both studies (*p*-value of Natalie= 0.658).

The result showed that shorter duration of diabetes could better control than longer. Therefore, duration of having DM was one of barrier to achieve blood glucose control. The attention should be given to longer duration of the disease in practicing self-care of diabetes.

5.3.2 Adherence to visit DM clinic and Blood Glucose Level Control

The respondents who had more adherences to visit DM clinic were better control or vise versa. The results showed that 79.1% of subjects those who had good adherence to DM clinic. The good adherent respondents had better control than the nonadherence group. Nearly three fourths of poor adherence group had poorly controlled. Despite the fact that about 60.0% of both good and fair adherence groups were poorly controlled. This finding supported the study of Donald and Nancy (43) that found typically show rates of noncompliance ranging from 38.0 to 75.0%, with

higher rates being associated with longer-term, lifestyle-changing behaviors. Diabetes patients are largely nonadherence groups, with some studies finding that only 7.0% of patients surveyed were judged to be fully adhering with all aspects of their regimen. Nevertheless, this study revealed that the association was not found significantly which against the study of Andrew et al (57) that found adherence was associated with significantly better BG level control.

In fact, there was a decline in the level of control as the period of attendance increased. Some patients were unable to receive their medication at the time of their appointment since medication was not always available at the clinic.

5.3.3 Regularity of taking medication and Blood Glucose Level Control

Although lifestyle measures (medical nutrition therapy and appropriately prescribed physical activity) may suffice alone to reach BG level targets in some patients with type 2 diabetes, a combination of lifestyle measures and pharmacologic treatment is often required (44). Medical noncompliance is pervasive in health care. This study found that the proportion of poor BG level control is twice as much as good control but for irregular group the proportion of good control is high. 84.50% of subjects took DM medication regularly. One third of those who took medication regularly had good BG level control. A forty percent of those who had irregular taking medication were poorly controlled. Corresponded to Hsing-Yi Chang et al (31) that showed 70.8% among diabetes took medication regularly. However, this finding was contradictory shown that BG level control was significantly related to taking medication regularly (*p*-value = 0.027) in spite of the reverse association. While this finding was not support by the study of Natalie (39) who found that there was no correlation between pharmaceutical treatment and glycemic control.

Diabetes is a chronic disease, and strict pharmacological intervention is desirable to improve outcome in patients. Therefore, lapses in drug therapy would negatively impact on the patient's glycemic control. Patients also may not achieve glycemic goals because of their failure to fully adhere to lifestyle measures and pharmacologic treatment regimens. Patient nonadherence to lifestyle measures and pharmacologic

therapies are the most common reasons cited for failure to achieve glycemic goals. Diabetes patients who do not adhere to nonpharmacologic and pharmacologic therapy and lack motivation were cited as significant having obstacles to achieving optimal diabetes care (43). Generally, it is easier to take medicine than to make changes in lifestyle. If one is asked to take medicine regularly, more than 50.0% of people comply. Some diabetics might not need medication, if the disease could be controlled by using exercise, weight and diet control, reduced smoking, and so forth. The longer duration of the disease still significantly associated with regular medication.

5.3.4 Body Mass Index and Blood Glucose Level Control

The health care burden of diabetes is related to 2 key risk factors, an increasing prevalence of obesity and overweight for the development of type 2diabetes. This study found that about 38% of the respondents' BMI had normal BMI and underweight whereas both overweight and obese were 62.0% of respondents. The analyses of International Obesity Task Force (IOTF) indicate that approximately 58.0% of DM globally can be attributed to BMI above 21 kg/m^2. A higher percentage of the population with BMI more than 30 kg/m^2 is associated with a higher percentage of the population with diabetes (49).

The results of this study showed that the weight was increasing, the trend of BG level control was decreasing. Underweight group could control BG level better than the others. Nearly one half of the underweight respondents had well controlled. Considering poor control, the respondents who had obese level 1 were 83.7%. Nevertheless the association was not found significantly similar to the study of Eva TA et al (58), it mentioned that there were no significant differences with respect to weight, BMI and HbA1c.

Richard's study (59) found that abdominal obesity was associated with decreased diabetes awareness and glycemic control in women. Subjects with abdominal obesity were found to have poorer glycemic controls compared to those without abdominal obesity.

The epidemic of obesity will inevitably have far reaching consequences for society and health services. Diabetes services cannot on their own expect to make an impact on the problem of lifestyles leading to diabetes, but the efforts aimed at the prevention of obesity and type 2 diabetes must be extended. The avoidance of overweight and obesity is strongly recommendation for prevented or delayed complications of diabetes through effective management diabetes.

5.3.5 Hypertension existing and Blood Glucose Level Control

Poor BG level control, HT and hyperlipidaemia synergistically contribute to the development of microvascular and macrovascular complications in patients with type 2 diabetes mellitus such as retinopathy and nephropathy. The ADA has recommended that BP be maintained at <130/<80 mm Hg in patients with diabetes with the use of lifestyle modification (medical nutrition therapy and appropriately prescribed physical activity) and, if necessary, pharmacologic therapy (44).

Although HT was major co-morbidity of DM, Moshen's study (21) found that 43.4% of diabetes had HT, while Hsing-Yi Chang (31) found that 48.0% of diabetes patients had HT too. This study found that the respondents who without HT had better control than those who had hypertension. Two thirds of respondents who had HT were poorly controlled. Corresponded to Ole Torffvit et al (22) showed that poor metabolic control was associated with development and high BP with progression of nephropathy in type 2 diabetic patients. However, the association was not found significantly which supported the study of Mohsen et al (21) that found fasting BG had no significant independent association with HT when other covariates were considered.

5.3.6 Diet Control Status and Blood Glucose Level Control

The results found that all respondents had the appropriate behavior for taking food. Nevertheless, about one half of respondents had taken sticky rice everyday and only 17.2% of respondents kept away from sticky rice. More than one half of respondents had inappropriate rice taking behavior. Because of this reason, therefore, the result of diet control status assessment was 53.5% of inappropriate diet control

behavior. The proportion of appropriate and inappropriate diet control among the respondents were approximately equal and the distributions of BG level control were not much differed for both groups. This finding supported by the study of Hsing-Yi Chang et al (31) that showed 64.7% of diabetes used diet control. Steven's study (48) in the United States found that, 77.0% of diabetes patient fail to consume a healthful diet are at elevated health risk. The number of individuals in the intervention group who were diabetic at baseline was 38.0% reduction in diabetes prevalence and a significant reduction in FBG. The reductions in FBG, body fat and body weight reported are similar to improvements from other evaluations of the program. There was no significant different in intervention group (*p*-value = 0.269) and in control group (*p*-value = 0.511) in the same time this study found that BG level control was no significantly associated with diet control status.

From this study, the respondents were known well about appropriately food taking behavior. High fiber diet which contains adequate amounts of unsaturated and lean protein was choosing to improve satiety. But most of them couldn't avoid glycemic load from sticky rice because it is the main rice of this area. However, diet still is the cornerstone for the management of diabetes and important for diabetes control. Lifestyle modification program is an efficacious nutrition for diabetes control especially healthy diet.

5.3.7 Physical Activity and Blood Glucose Level Control

Exercise has been recommended to control for diabetes. Two key component of exercise are the frequency and duration. This study found that one half of respondents had the proper exercise frequency. But the majority of respondents were improper the exercise duration. It causes improper physical activity assessment quite high (97.7%). Since almost all of the respondents had improper physical activity, therefore the BG level was not so good. This relationship was found to be of no significance. This study supported by the study of Hsing-Yi Chang (31) had shown that 40.0% of diabetes had exercise. Steven et al (48) found that 78.0% are at elevated health risk because they do not get enough physical activity and there was no significant different.

Physical inactivity, both a cause and consequence of weight gain, also contributes to insulin resistance. It causes difficult to accomplish good BG level control. Most of respondents still realized in exercise, but spent time only 20 minute each. A few of respondents were lack of physical activity. Other consideration, some respondents' occupation was farmer and agriculture which work characteristics relatively apply physical activity.

5.3.8 Cigarette Smoking and Blood Glucose Level Control

This study revealed that 84.50% of respondents didn't smoking and only one third of non-smoking respondents had good BG level control. Nevertheless, 60.0% of smoking respondents had well controlled which supported the study of Bjorn Eliasson (52) that found smoking cause a trend towards lower fasting levels (*p*-value = 0.08). The finding of this study revealed that relationship between BG level control and cigarette smoking was found to be of significance with *p*-value = 0.027.

Roberts and Edelman (60) found that the overall smoking rate for Vermonters with diabetes was lower than the rate for those without diabetes but the age-adjusted rates for smoking were similar diabetic.

In addition to findings from other studies, they found that those with negative health behaviors, such as smoking, tended not care for their disease (31). In diabetes care, smoking cessation is of utmost importance to facilitate glycemic control and limit the development of diabetic complications.

5.3.9 Alcoholic Consumption and Blood Glucose Level Control

Hsing-Yi Chang et al (31) had shown in their work that 16.6% of diabetes patients drank alcohol. Similar to this study found that only 11.63% drank alcohol. Two thirds of those who drink alcohol had poorly controlled. Nearly 40.0% of non-drinking respondents had good control. The relationship was not found significant. On the other hand, the study of Todd Mackenzie et al (53) suggested that adults with diabetes who drank alcohol had better glucose control is supported by a small

randomized controlled trial that found that acute alcohol consumption improved insulin action in persons with type 2 diabetes.

5.4 The Relationship between BG Level Control and Knowledge about DM

In this study, it was found that 48.8% of the respondents acquired good knowledge. The mean was 16.2 and standard deviation was 2.3. The range was 10.0 – 20.0. If we look at the mean, it's quit high and a few of SD, this shown that the respondents had the knowledge very well.

Concerning details of the respondents' DM knowledge, the majority of the respondents knew very well about definition, sign & symptom of DM, alcohol control and their self-responsibility. The knowledge of diet control and exercise also knew fair to well. About DM complication, the respondents also knew very well including foot care, eye problem and neuropathy, except the effect to heart disease (42.6%) and renal problem (60.5%). Knowledge regarding diabetes was considered as positive if the answers were that diabetes was associated with heart and renal problems. These questions may be difficult to understand which respondents may be confuse or lack of knowledge. However the respondents got poor about the knowledge of treatment which asked about medication. Because the treatment wasn't directly responsiveness of respondents, and they didn't know the other alternative as well as step of treatment.

The result revealed that the proportion of good and fair/poor knowledge about DM was rare or less the same but the percentage of BG level control among fair/poor groups were noticing higher than the good one. Nevertheless BG level control was no significant relate to knowledge. Corresponded to Murugesan et al (54) that showed types of healthy physical activity, healthy diet and measures to improve health were fairly well known to the participants, details of unhealthy diet, causes of diabetes and details about diabetic complications were not known to many. In the total study group, 41.0% were unaware of health being affected by diabetes and only less than 30.0% knew about complications related to kidneys, eyes and nerves. However, they found that there were significant only about knowledge regarding causes of diabetes,

its prevention and complication (*p*-value = 0.0001). While there were no significant difference between diabetes and the other determinants of knowledge including physical activity, healthy diet, measures to improve health, symptoms of diabetes and affects daily life. Diabetic subjects had better knowledge about symptoms of diabetes and the preventive aspects. However, Yi-Der et al (56) confirmed that the intensity of diabetic education was the only significant variable correlated with the decrease of FBS. Their study led to significant (*p*-value <0.001).

Hsing-Yi Chang et al (31) illustrated the real situation of diabetes control in the population. The results implied that specific knowledge and emphasis on self-care of diabetes should be given in the early stage of the disease, younger age, with less complications and shorter duration of disease.

Adequate knowledge and skills are essential to the success of diabetic control. The empowerment group education did improve patients' confidence in diabetes knowledge with maintained BG level control despite the progressive nature of the disease. Improvements have been found in BG level control, problem-solving ability, diabetes knowledge, attitudes towards diabetes, well-being and treatment satisfaction. The greatest effects have been shown in BG level control in short-term follow up (<6 months), while the effect of long-term follow-up has been shown to be dependent on the amount of time spent with the patients (58).

CHAPTER 6
CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This cross-sectional study was conducted in Maeprik District, Lampang province, Thailand to describe the determining factors of the effectiveness of BG level control and to measure the effectiveness of BG level control among diabetes patients in fiscal year 2005. The determining factors consisted of the socio-demographics, patient factors and knowledge about DM. Another aim was to identify association between independent and dependent variable. The data was collected from one hundred and twenty nine diabetes patients using structured questionnaire done by the researcher.

The trend of Maeprik diabetes frequency was increasing with the higher age. Approximately 80.0% of diabetes patients were more than fifty years old. Female prevalence was higher than male. Three fourths of respondents were married. One half of diabetes patients were farmer and agricultures. The majority of patients were finished primary educational status (80.6%). However, there was no significantly association between all socio-demographic factors and the level of BG level control.

Concerning the patient factors, shorter duration of diabetes had better control than longer. About one half of the respondents had less than five year's having DM. The majority of respondents had good adherence to visit DM clinic (79.1%) as well as those who took DM medication regularly (84.5%). The respondents who had more adherences to visit DM clinic were better control or vise versa. For taking medication, the proportion of poor BG level control among regular taking group is twice as much as good control, but for irregular group the proportion of good control is high. It was contradictory shown that the significant statistically association of BG level control and taking medication regularly (*p*- value = 0.027).

It found that 62.0% of respondents had overweight and obesity. The 56.6% of diabetes didn't have comobidity of hypertension. Concerning diet control status, the proportion of appropriate and inappropriate diet control distribution of BG level control were not much differed for both groups. Since almost all of the respondents had improper among the respondent were approximately equal and the physical activity (97.7%), therefore the BG level was not so good.

The majority of respondents weren't smoking (84.5%) as well as no alcohol consumption (88.4%). Only one third of non-smoking respondents had well controlled but 60.0% of smoking respondents had well BG level controlled. The data revealed that BG level and cigarette smoking had statistically significant association (*p*-value = 0.027).

However, the other patient factors were not significantly associated with BG level control.

Regarding the knowledge, the proportion of good and fair/poor knowledge about DM was rare or less the same (49.0 vs. 51.0%) but the percentage of BG level control among fair/poor groups was higher than the good level (42.4 vs. 33.3%). Nevertheless, it was not found to be significantly associated with BG level control.

In summery, although poor control was higher than good control and almost determining factors didn't show significantly associated with BG level control. The researcher considered that older , male gender, shorter duration of having DM, underweight, absent HT and cigarette smoking were the important determining factors of the good effectiveness of BG level control among diabetes patients in this area. Because of the noticeable high percentage of good control was verified in these factors. Another concerning it was how to increase the patients' awareness of DM. Therefore, not only these determining factors should be center of attention but also the raising of diabetes patients' awareness should be considered to improve the effectiveness of BG control level in this area.

6.2 Recommendations

6.2.1 Recommendations for implementation

There were many things learned from this study for diabetes care improvement in Maeprik health services and among diabetes patients. The goal of diabetes management is to ensure the quality of diabetes care improvement and to prevent diabetes complications and thereby decrease morbidity, mortality and the cost of DM treatment. The following recommendations are suggested:

1) To improve the effectiveness of blood glucose control

The results of this study showed that the mean of BG level was 133 mg/dl and most of the respondents had poor BG level control. The optimal BG level might be one of affecting factors to regarding. Due to an optimal BG level is also the key role of the follow up treatment and diabetes management. This study refers the optimal value at 80-120 mg/dl from many reliable literature reviews including Thailand's researches. Therefore, the optimal BG level should be considered carefully to accomplish the effective diabetes treatment and prevents its complications in the future.

From the experiences of 9 years working in Maeprik Hospital, the researcher thought that one reason for poorly controlled levels was misunderstanding of Maeprik's personnel about the optimal level of BG control. Most of the personnel realized that to keep the level of BG control around 140 mg/dl is higher than the reference value (80-120 mg/dl). If we consider the mean of FBS level in this study, 133.0 mg/dl, they could control it very well. Therefore, this study highlights the fact that there is a need for re-evaluation of the diabetic program, particularly the effective optimal BG level which helps to accomplish prevention of its complication and diabetes management effectively.

2) To increase awareness of life modifications for diabetes patients

Life style and changed behavior are essential in diabetes care. Particularly obesity, diet control and physical activity should be considered in this area. Life

modifications include both efficacious nutrition and physical activity intervention in the short term, and has the potential to dramatically reduce the risks associated with common chronic diseases in the long term.

Although most respondents did well in the knowledge part, DM knowledge however was not significantly associated with BG level control. The reason supported may arise from unawareness of diabetes patients. The results from this study have implications for patient's BG level control efforts. It is seen that the BG level control is a main predictive factor. Hence clinicians need to strive to improve overall levels of patients' awareness and knowledge of their specific conditions. Many opportunities exist for raising diabetic's awareness of their disease and linking diabetic's growing health awareness with those health-promoting behaviors known to reduce morbidity and mortality.

6.2.2 Recommendation for further studies

1. Further research should focus more on other important patients factors regarding perception and skill, family support and social support as well as health education programs and patients life modification. Other interest factors, for instance, are accessibility, treatment regimen comparison, rural and urban area comparison.

2. Further research may focus on the relationship of the DM health service provider side with the effectiveness of BG level control.

3. About BG monitor, if possible, further research should screen for HbA1C because it supplies more reliability and specificity than fasting BG level. Economy and availability should be considered in this case.

4. Further research should focus on the interrelationship of each independent variable including socio-demographic factors, patient factors and knowledge about DM.

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APPENDIX

APPENDIX A

QUESTIONNAIRES

Prepared for the Master theses entitled "determining factors of the effectiveness of blood glucose level control among diabetes patients in Meaprik District from October 2005 to September 2006"

The answers to this survey will be use to improve health program that might help you. Some questions are personal but desirable answer in order to get useful information. Your answer will keep completely confidential and will not be exposing for any other purposes. Please make every effort to answer each question as honest as possible. The interview should take about 15-20 minutes. If you have any questions, please feel free to ask the interviewer.

Part 1 General information

Name-Surname.....

Age ☐ Years Body weight ☐ kgs Height ☐ m.

Gender

☐ Male ☐ Female

Marital status

☐ Single ☐ Married ☐ Divorced ☐ Widow

Occupation

☐ Agriculture ☐ Laborer ☐ Merchant

☐ Civil servant ☐ Unemployed ☐ Other specify.....

Education

☐ Illiterate ☐ Primary school ☐ Secondary school

☐ Higher than secondary school

Part 2 Patient factors

Duration of having diabetes

☐ < 5 Yrs. ☐ 5-10 Yrs. ☐ 11-15 Yrs.

☐ 16-20 Yrs. ☐ > 20 Yrs.

Adherence to visit DM clinic

☐ No missing ☐ 1 Missing/yr ☐ > 1 Missing/yr

Regularity of taking medication

☐ Regular ☐ Irregular

Hypertension Status

☐ Present ☐ Absent

Cigarette smoking

☐ Frequent ☐ Sometimes ☐ Never

Alcoholic consumption

☐ Frequent ☐ Sometimes ☐ Never

Diet control behavior

How often did you eat these foods in the last week?

Rice	**Everyday**	**4-6 dys**	**1-3 dys**	**< 3 dys**	**No. of meal**
Sticky rice					
Steam rice					
Boil rice					
Food					
Vegetable					
Chili paste					
Food with saturated fat					
Food with unsaturated fat					
Curry soup with coconut milk					
Fruit					

Others (specify).....

Physical activity

1. How many days did you have exercise in the last week?

☐ 1) < 3 days ☐ 2) 3-5 days ☐ 3) > 5 days

2. How long did you spend time during each exercise in the last week?

☐ 1) < 10 min ☐ 2) 10-20 min ☐ 3) 21-30 min
☐ 4) 31-40 min ☐ 5) > 40 min

Part 3 Knowledge about DM

Please check √ followed your understanding

Statement	Agree	Undecided	Disagree
1. Diabetes is a group of diseases marked by high blood glucose level.			
2. Diabetes can lead to serious complications and premature death.			
3. Diabetes patients can adjust anti-diabetic medication by themselves.			
4. Frequent urination is one of diabetes symptom.			
5. Foot care is important for diabetes patients. If your feet got wound, you should early visit hospital.			
6. Blood sugar monitoring is not a key part of the diabetic treatment program.			
7. Diabetes is not attributed to heart disease.			
8. Poorly-controlled diabetes can lead to blindness.			
9. Diabetes can leading to peripheral neuropathy.			
10. Diabetes patient should avoid alcohol drinking.			
11. High blood sugars can not be cause of renal problems.			

Statement	Agree	Undecided	Disagree
12. The first line treatment of diabetes is taking medication.			
13. All diabetes patients are initiated by taking an oral medication.			
14. People with diabetes must take responsibility for their day-to-day care.			
15. BP and cholesterol level is not necessary to control in diabetes patients.			
16. Vegetable and fruit are suitable food for diabetes patients.			
17. Food cooking with saturated oil is better than unsaturated oil.			
18. If we go walking everyday and more than 30 minutes each, it is sufficient for diabetes patients.			
19. If we go running 45 minutes per day and 3 days per week, it is sufficient for diabetes patients.			
20. If your fasting blood glucose is 200 mg/dl, it means good control.			

APPENDIX B

Table 17 Monthly Fasting Blood Glucose Level Record of each Respondents

Month	FBS
October 2005	
November 2005	
December 2005	
January 2006	
February 2006	
March 2006	
April 2006	
May 2006	
June 2006	
July 2006	
August 2006	
September 2006	
Average	

APPENDIX C

Table 18 The Results of the Respondents' Selection about Type of Rice and Food in the Previous Week.

Item	Everyday		4-6 dys		1-3 dys		Not eat	
	No.	%	No.	%	No.	%	No.	%
Rice								
Sticky	61	47.3	23	17.8	23	17.8	22	17.1
Steam	48	37.2	37	28.7	23	17.8	21	16.3
Boil	4	3.1	5	3.9	6	4.6	114	88.37
Food								
Vegetable	106	82.2	14	10.8	8	6.2	1	0.8
Chili paste	67	51.9	20	15.5	30	23.3	12	9.3
Food with unsat. fat	0	0.0	0	0.0	4	3.1	125	96.9
Food with sat. fat	7	5.4	12	9.3	72	55.8	38	29.5
Fruit	33	25.6	28	21.7	59	45.7	9	6.98
Coconut dessert	0	0.0	3	2.3	15	11.6	111	86.1

BIOGRAPHY

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