CHAPTER II

LITERATURE REVIEW

This study uses an application of the Health Belief Model to study behavior among population at Wangkeeree Sub-District, Huai yot District, Trang Province. The researcher studied information, concepts, and theories relevant for a guideline to operate the activities as follows:

Part 1 Knowledge about diabetes mellitus

Part 2 Theory : Health Belief Model

Part 3 Research about DM

Part 1 Knowledge about Diabetes Mellitus

1.1 Definition of Diabetes Mellitus

Diabetes is a disease in which the body doses not produce or properly use insulin. Insulin is a hormone that coverts sugar, starches and other food into energy needed for daily life. Without insulin, sugar builds up in the blood.

1.2 Types of diabetes mellitus

There are two main types of diabetes mellitus called quite simply type 1 diabetes mellitus and type 2 diabetes mellitus.

Type 1 diabetes mellitus (old names were juvenile onset diabetes and insulin dependent diabetes) is an autoimmune disorder caused by destruction of the insulin producing cells of the pancreas, an organ in the abdomen. Insulin is the main blood glucose lowering hormone of the human body. In type 1 diabetes, the immune system, normally responsible for defending the body against bacterial and viral infections attacks the islet cells of the pancreas that produce insulin and attempts to destroy them. This process may smolder for years, but when approximately 90 percent of insulin producing cells have been destroyed, there is too little insulin circulating to maintain blood glucose concentration in the normal rage. As blood glucose rises, symptoms of diabetes develop. If the loss of insulin production is nearly complete and insulin treatment has not been started, a life-threatening condition called diabetic ketoacidosis may develop. In keteacidosis, plasma glucose is typically greater than 500 mg/dl. By products of fat metabolism called ketones build up in the blood and the blood becomes acidic. Immediate treatment with fluids and insulin is essential. Although once thought to be a disease of children and adolescents, we now recognize that type 1 diabetes can begin at any age. Type 1 diabetes requires a genetic (inherited) predisposition, which occurs most often in the people of Northern European ancestry. Type 1 diabetes accounts for 10 percent of all diabetes. It often pops up unexpectedly in a family.

Type 2 diabetes mellitus (old names are adult onset diabetes and non-insulin dependent diabetes) is due to lack of response or resistance to insulin accompanied by inability to produce sufficient insulin to overcome that resistance. Being overweight is the main factor that causes insulin resistance. Type 2 diabetes mellitus is often accompanied by a group of abnormalities including obesity, increased abdominal fat,

high blood pressure and abnormalities of blood fats (low HDL cholesterol and high triglycerides). People with type 2 diabetes mellitus usually do not develop diabetic ketoacidosis. Type 2 diabetes mellitus also appears to require a genetic predisposition. However, it occurs frequently in people of all races and ethnic backgrounds and accounts for about 90 percent of all diabetes. Type 2 diabetes usually affects people with a family history of diabetes. A third type of diabetes mellitus is called gestational diabetes. This condition can occur during pregnancy, is similar to type 2 diabetes, and usually goes away after the pregnancy is complete. Women with gestational diabetes are at increased risk of type 2 diabetes mellitus later in life.

1.3 Causes of type 2 diabetes mellitus

1. Causes of Insulin Resistance: Elevated levels of three factors are believed to be involved in the development of obesity and insulin resistance leading to diabetes mellitus. They are: free fatty acids (acids in the blood produced by breakdown of fat), leptin (a protein produced by fat cells), and tumor-necrosis factor, or TNF (a component of the immune system). How each of these factors produce contributes to type 2 diabetes mellitus is under investigation.
2. Genetic Factors: Genetic factors play an important role in diabetes mellitus, but the pattern is complicated, since both impairment of beta cell functions and an abnormal response to insulin are involved. Researches have identified a number of genetic suspects. In certain Caucasian populations, a single gene may alter the

metabolism of fatty acids that leads to insulin resistance. Researchers have also identified the P2 gene, which appears to be critical for the link between obesity and insulin resistance. Australian researchers have identified a defective lipoprotein lipase (LpL) gene, which poses a risk for coronary artery disease and type 2 diabetes mellitus in people who have it. Researchers recently identified a defective gene that regulates glucose metabolism. This may provide the link between low birth weight and a later risk for type 2 diabetes mellitus and insulin resistance. A defective gene has been detected that reduces activity of a protective substance called B_3-adrenergic receptor, which is found in visceral (organ) fat cells. The result is a slow-down in metabolism and an increase in obesity. The defective gene has been found in Pima Indians and other populations with a very high incidence of type 2 diabetes mellitus and obesity. One theory suggests that some cases of type 2 diabetes and obesity are derived from normal genetic actions that were once important for survival. Some experts postulate the existence of a so-called "thrifty" gene, which regulates hormonal fluctuations to accommodate seasonal changes. In certain nomadic populations, hormones are released during seasons when food supplies have traditionally been low, which results in resistance to insulin and efficient fat storage. The process is reversed in seasons when food is readily available. Because modern industrialization has made high carbohydrate and

fatty foods available all year long, the gene no longer serves a useful function and is now harmful, because fat, originally stored for famine situations, is not used up. Such a theory could help explain the high incidence of type 2 diabetes mellitus and obesity found in Pima tribes and other Native American tribes with nomadic histories and Western dietary habits.

Risk factors

Diabetes, particularly type 2, is reaching epidemic proportions through the world as more and more cultures adopt Western dietary habits. Currently an estimated 100 million people have diabetes and experts predict that by 2010 this number will double. In the U.S. alone, it is estimated that 16 million people have diabetes and that about half are unaware they have it.

1. **Age:** The onset of type 2 diabetes mellitus typically occurs after the age of 30. Aging itself may increase the risk for glucose intolerance and diabetes mellitus. In one study, diabetes occurred in only 5.9% of men and 3.8% of women younger than 60 years but in nearly 20% of men and women older than 85 years. Although still very uncommon of major concern is a significant increase in type 2 diabetes mellitus in children, possibly due to rising rates of childhood obesity.
2. **Obesity:** The rate of obesity is very high in type 2 diabetics, and some studies have found that, regardless of family history, even modest weight gain is associated with an increased risk for diabetes. Excess body fat appears to play a strong role in insulin resistance, but the way it's

distributed is also important. Weight concentrated around the abdomen and in the upper part of the body is associated with insulin resistance and diabetes mellitus, heart disease, high blood pressure, stroke, and unhealthy cholesterol levels. Fat that settles in a "pear-shape" around the hips and flank appears to have a lower association with these conditions. One study suggested that waist circumferences greater than 35 inches in women and 40 inches in men signify increased risk for heart disease and diabetes.

3. **Smoking:** Smokers are at higher risk for both type 2 diabetes mellitus and its complications.
4. **Family History:** About 33% of all patients have a family history of the disease, and people with first degree relatives have 40% lifetime risk for diabetes.
5. **Ethnicity:** The risk for type 2 diabetes mellitus is higher in African and Hispanic Americans than in Caucasian-Americans. One study found that African-American women in general have a higher rate of insulin resistance from high-fat diets than do non-African-Americans, suggesting the presence of a genetic factor. The Pima tribe in Arizona has an incidence of type 2 diabetes that is 19 times higher than that of the white population. The association between diet and diabetes remains critical, however, in assessing these ethnic differences. In one study, Mexican Pimas had lower fat (but higher overall calorie) intake and more intense physical activity than Arizona Pimas. They also had only a 6% incidence of obesity and diabetes, which was equivalent to their non-

Pima neighbors. The incidence of diabetes in their Arizona Pima relatives, however, was 40%. Other Native American tribes in North American are also at high risk for type 2 diabetes.

6. **Risk Factors for Gestational Diabetic Mellitus:** Even modest weight gain (11 to 22 pounds) during early adulthood increases the risk for gestational diabetes (temporary diabetes during pregnancy). Other risk factors include a family history of diabetes, smoking, belonging to African American, Hispanic, or Asian ethnic groups, gaining weight before getting pregnant, and being an older mother. In women who develop gestational diabetes during pregnancy, taking contraceptives and only have breast feeding puts them at high risk for developing type 2 diabetes mellitus.

1.4 Signs and symptoms

Diabetes mellitus usually begins and progresses slowly. Symptoms may not appear for years, even decades. The signs and symptoms include; excessive thirst and drinking a lot of fluid, increased urination, weight loss in spite of increased appetite, fatigue, nausea and vomiting, frequent infections including skin, vaginal and bladder, blurred vision, impotence in man, breath odor, cessation of menstruation, and poor skin turgor. Additional symptoms that may be associated with these diseases are; gums bleeding, ear noise/buzzing, diarrhea, depression and confusion

1.5 Diagnostic test

A healthcare provider may suspect diabetes mellitus in patients who have symptoms such as excessive thirst and frequent urination. He or she may also suspect diabetes if there is an abnormal amount of glucose (sugar) in the blood or urine. When blood glucose rises above a certain point, the kidneys pass the extra glucose into the urine. However, a urine test alone is not sufficient to diagnose diabetic mellitus because glucose does not "spill over" into urine until fairly high levels are reached. Therefore, healthcare providers use blood tests that measure glucose concentrations to diagnose diabetes.

Three blood tests are generally used for diagnosis. Based on these tests and a physical exam, a healthcare provider can decide whether a person has diabetic mellitus.

Fasting Glucose Test

One method for diagnosing diabetes is a fasting glucose test. It requires that a person does not eat or drink anything for approximately eight hour prior to the test. For this reason, it is usually done in the morning before breakfast. A normal fasting glucose level is less than 110 mg/dl (milligrams per deciliter). Fasting glucose levels between 110 and 125 mg/dl indicate some problem with glucose metabolism. A fasting glucose level of greater that or equal to 126 mg/dl indicates a diagnosis of diabetes.

Random Plasma Glucose Test

A random plasma glucose test measures the amount of glucose in the blood at any given time. The test does not require fasting (abstaining from eating for a specified

length of time) and therefore may be done at any time. A random glucose value of greater than or equal to 200 mg/dl (milligrams per deciliter) indicates a diagnosis of diabetes.

Oral Glucose Tolerance Test

A healthcare provider may decide to recommend an oral glucose tolerance test (OGTT). Sometimes the OGTT can detect diabetes when a simple blood sugar test does not. In this test, blood glucose is measured before and after a person has taken a sweet drink of glucose and other sugars. Normally, the glucose in a person's blood rises quickly after swallowing the drink and then falls gradually again as insulin helps the body to metabolize the glucose. In someone with diabetes mellitus, the glucose value remains high (greater than or equal to 200 milligrams per deciliter or mg/dl) two hours after consuming the drink. This test is not routinely done because of the time required and because there are better tests available. It is not considered very precise, and results are frequently not repeatable. However, it may be a useful test for people who have problems with fasting glucose levels (110 to 125 mg/dl on glucose level)

Test for Glycosylated Hemoglobin.

Another test examines blood levels of hemoglobin A 1 c (GbA 1 c) also called glycosylated hemoglobin. Hemoglobin, a protein molecule found in red blood cells, becomes modified by having glucose bound to it. Much evidence exists that this process, called glycosylation, affects a number of proteins and is strongly associated with complications of diabetes. Measuring glycosylated hemoglobin is useful for predicting complications in patients with existing diabetes. The test is not affected by

food intake so it can be taken at any time. A glycosylated hemoglobin level of 1% above normal range identifies diabetes in 98% of the patients. Normal HbAlc levels are less than 7%. The test is not currently used for an initial diagnosis, but some experts think it should be used to help predict complications in people who have FPG levels that are above normal but do not indicate full-blown diabetes (110-139 mg/dL).

1.6 Complication of diabetes mellitus

Diabetes mellitus is a systemic disease that affects essentially every organ of the body. The fatal outcome is related to the development of acute or chronic complications, particularly the latter. Cardiovascular and renal lesions are the most common abnormalities that lead to death. Although the exact pathogenesis of the multi systemic organ involvement is only partially understood, considerable progress in this area has been made in recent years.

Acute complication infections. As previously mentioned, the diabetic patient is prone to acquire a variety to infections from different microorganisms. Bacterial pneumonia and urinary tract and skin infections are the most prevalence. Gram positive, as well as gram negative, organisms can be the causative agents. Fungal infections are also common, in particular, candidiasis of the skin and of the female external genitalia, and more rarely, mucormycosis of the nasopharynx and sinuses. Likewise, herpes and cytomegaiovirus infections can occur.

Ketoacidosis. Prevalence before the era of insulin therapy, ketoacidosis was the leading cause of death of patients with diabetes mellitus. Since insulin deficiency

worsens the clinical picture and leads to metabolic abnormalities, the complication is more common in young diabetics.

Lactic acidosis. Diabetes mellitus is one of the major causes of lactic acidosis, a serious condition characterized by excessive accumulation of lactic acid and metabolic acidosis. The hallmark of lactic acidosis is the presence of tissue hypoxemia, which leads to enhanced anaerobic glycolysis and to increased lactic acid formation. Hypotension and shock are the usual predisposing factors.

Chronic complications

Complication of eye cataracts. This complication occurs commonly in patients with long standing diabetes mellitus and may be related to uncontrolled hyperglycemia.

Retinopathy. This condition is the most common cause of blindness in patients under age 65 Macular edema, retinal detachment, and vitreous hemorrhage are the immediate causes of diabetic blindness.

Hypertension is common in patients with diabetes, particularly in the presence of renal disease. Suppressed plasma renin is often encountered, but the mechanism is not known. Decreased renin synthesis secondary to destruction of the juxtaglomerular cells, sympathetic nervous system dysfunction, and volume expansion have been postulated.

Renal complications. Renal failure develops in half of the patients with Type 1 diabetes within 20 years of onset of the disease but light microscopic evidence of glomerulosclerosis is found in at least 90 percent of patients. Microalbuminuria of more than 30 mg/min correlates with the development of clinical diabetic nephropathy 14 years thereafter. Hypertension causes an acceleration of the onset of renul failure, and aggressive antihypertensive therapy reduces the rate of decline of renal function.

Skin complication; The skin is a common target of diabetes mellitus. Many lesions can be observed, but none is specific to the disease, with the possible exception of necrobiosis lipoidica diabeticorum. The most common skin lesion is diabetic demographic, which is characterized by brown, atrophic, well demarcated areas in the pretibial region which resemble scars.

Metabolic complication: hyperlipoproteinemia, Abnormalities in circulating lipids are often seen in patients with diabetes mellitus. The most characteristic pattern is that of increased very low density lipoprotein VLDL, which is manifested by elevation of plasma triglycerides and cholesterol.

1.7 Self-care for diabetes mellitus

1. **Dietary control**: For most people with diabetes, diet control is the key to managing this complicated disease. It is also extremely difficult. The current state of the diabetic diet is in flux, and at this time, there is no single diet that meets all the needs of everyone with diabetes. Patients should meet with a professional dietitian to

plan an individualized diet that takes into consideration all health needs. There are some constants, however. The general rules for healthy eating apply to everyone: limit fats (particularly saturated fats and fatty acids), protein, cholesterol, and consume plenty of fiber and fresh vegetables. All people with diabetes should aim for healthy lipid (cholesterol and triglyceride) levels and control of blood pressure. For overweight type 2 diabetics, both weight loss and blood glucose control are important. Health benefits are highest with the first pounds lost, and losing only 10% of body weight can control progression of diabetes.

Unfortunately, many of the oral medications used in type 2 diabetes cause weight gain. For obese patients who cannot control weight using dietary measures alone, weight loss drugs, such as orlistat (Xenical) or sibutramine (Meridia), may be beneficial. In one study, orlistat not only helped reduce weight but also improved glucose, cholesterol, and lipid levels. Surgical procedures are proving to be extremely beneficial in selected cases.

2. **Physical exercise**: Exercise helps lower blood glucose and increase insulin sensitivity; it also helps lower blood pressure, improve cholesterol levels, decrease body fat, and reduce the risk of cardiovascular disease. Aerobic exercise is best. Regular exercise, even of moderate intensity, improves insulin sensitivity and can even prevent type 2 diabetes. In fact, studies of older people who engage in regular moderate aerobic exercise (walking

or biking) lower their risk for diabetes even if they don't lose weight. For best and fastest results, experts advise frequent high intensity (not high impact) exercises for people who are cleared by their physicians. For people who have been sedentary or have other medical problems, lower intensity exercises are recommended using regimens designed with physicians. Patients who are taking medications that lower blood glucose, particularly insulin, should take special precautions before embarking on a workout program. Because diabetics may have a silent heart disease, they should always check with their physicians before undertaking vigorous exercise. Exercise, particularly resistance or high impact exercises, can strain weakened blood vessels in the eyes of patients with retinopathy. High impact exercise may also injure blood vessels in the feet.

3. **Monitoring Blood Glucose**: In patients being treated with insulin or insulin producing or sensitizing drugs, it is important to monitor blood glucose levels carefully to avoid hypoglycemia. Patients should aim for pre meal glucose levels of between 80 and 120 and bedtime levels of between 100 and 140. Blood glucose levels are generally more stable in type 2 diabetes than in type 1, so experts usually recommend measuring blood levels only once or twice a day. Usually, a drop of blood obtained by pricking the finger is applied to a chemically treated strip. The glucose level is read on a standard meter or a small, portable digital display device.

4. **Daily Foot Care**: Preventive foot care could reduce the risk of amputation by 44% to 85%. Patients should inspect their feet daily and watch for changes in color or texture, odor, and firm or hardened areas, which may indicate infection and potential ulcers. When washing the feet, the water should be warm (not hot) and the feet and areas between the toes should be thoroughly dried afterward. Moisturizers should be applied, but not between the toes. Corns and calluses should be gently pumiced and toenails trimmed short and the edges filed to avoid cutting adjacent toes. Patient should not use medicated pads or try to shave the corns or calluses themselves. They should avoid high heels, sandals, thongs, and going barefoot. Shoes should be changed often during the day. Tight stockings or any clothing that constricts the legs and feet should be avoided. A specialist in foot care should be consulted for any problems.
5. **Stress management:** When patients have stress, the body secretes substances to stimulate glyconeogenesis. This may cause the blood sugar level to increase. Stress may develop into depression, if it is not control.

Part 2 Theory : Health Belief Model

2.1 **The Health Belief Model** (Rosonstock, et al., 1988:175-183)

The Health Belief Model (HBM) will be used to guide this study. It was developed in the 1950 by a group of social psychologists at the U.S Public Health Service to explain the widespread failure of people to accept disease preventive or screening test for early detection of symptomatic disease. Later, the model was applied to patients' responses to symptoms and compliance with prescribed medical regimens. The model was viewed as potentially useful to predict those individuals who would or would not use preventive measures and to suggest intervention that might increase predisposition of resistant individuals to engage in preventive or health protecting behaviors.

The basic components of the HBM are derived from the work of Kurt Lewin (1944), a social psychologist, who conceptualized that the life space in which an individual exists is composed of regions, some having negative valence, some having positive valence, and others being relatively neutral. Illness is conceived to be regions of negative valence that can be expected to exert a force moving the person away from the positive valence region. Preventive behaviors are strategies for avoiding the negative valued regions of illness and disease.

These components examine the value placed by an individual on a particular outcome and the individual's estimation of the likelihood that a given action will achieve that outcome. The HBM describes individual health behavior to take action to avoid disease and then he would need to perceive that: (a) he was personally at risk of

the disease (susceptibility), (b) the occurrence of the disease would have at least moderate severity on his life (severity), and (c) taking a particular action would be beneficial in reducing his susceptibility to or the severity of the condition (benefits). Also, the action would not entail overcoming important psychological barriers such as cost, pain, and embarrassment (barriers). Modifying factors and cues to action that refer to the other variables that indirectly influence the health related behavior were introduced to the model by Becker and other in 1975 to improve the explanation of preventive behaviors . The details of the HBM are shown in figure 2.1

2.2 HBM Variables

Perceived susceptibility: Individuals vary widely in their feeling of personal vulnerability to a condition (in the case of medically established illness, this dimension has been reformulated to include such question as estimates of susceptibility, belief in the diagnosis, and susceptibility to disease in general). Thus, this dimension refers to individuals' subjective perception of his or her risk of contacting a disease.

Perceived severity: Feelings concerning the seriousness of contracting a disease or leaving a disease untreated also vary from person to person. This dimension includes evaluation of both medical/ clinical consequences (e.g., death, disability, and pain) and possible social consequences (e.g., effects of the conditions on work, family life, and social relation). The combination of perceived susceptibility and severity have described as *perceived threat*.

Perceived benefits: The action was influenced by beliefs regarding the relative effectiveness of available alternatives in reducing the disease threat to which the individual feels subjected. An alternative is likely to be seen as beneficial if it relates subjectively to the deduction of one's susceptibility or severity of an illness. The behavioral decisions are related to readiness of mind and the way chosen should to useful and have less barrier.

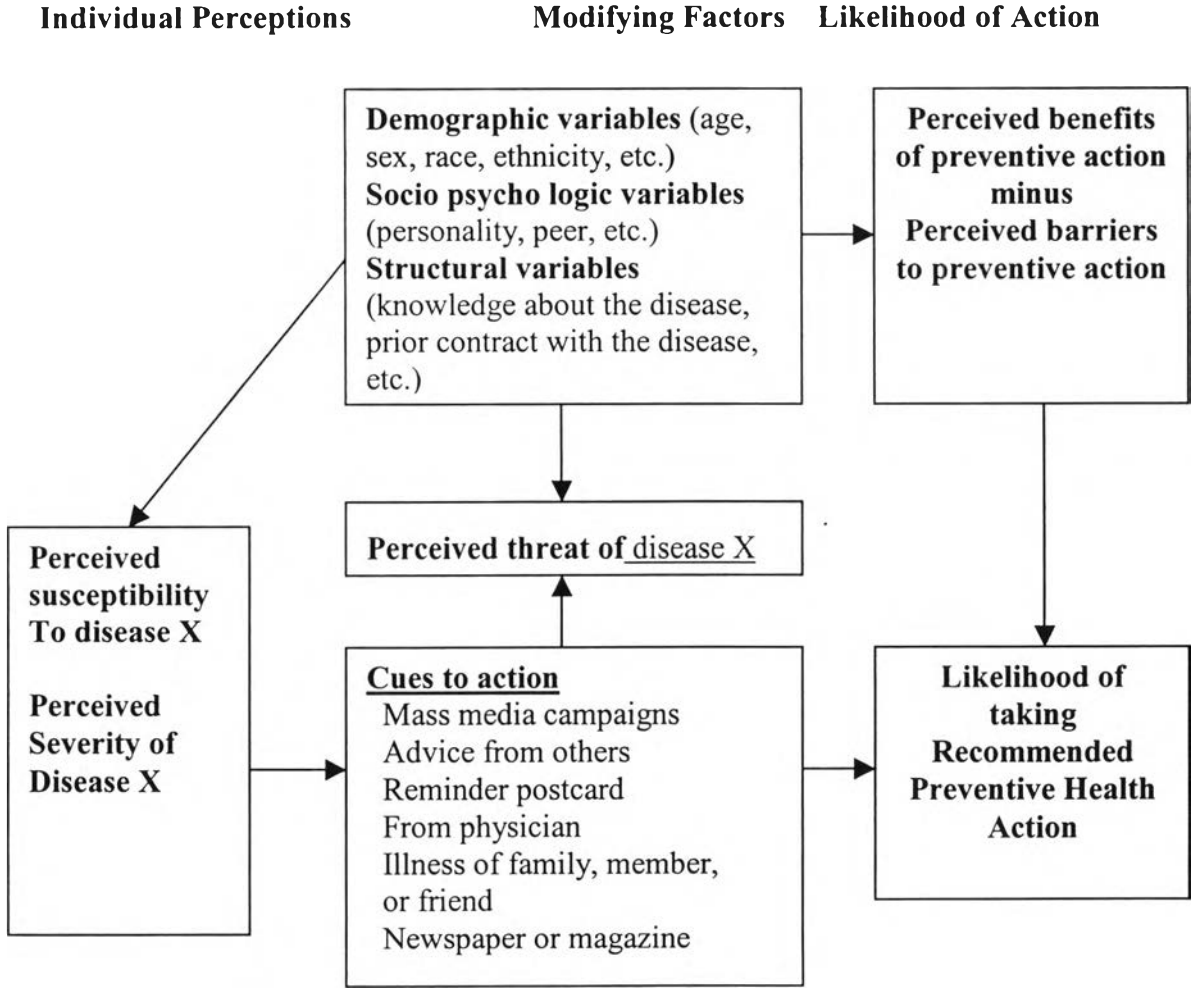

Figure 2.1 : The Health Belief Model as predictor of preventive health behavior

Source: Becker, Drachman & Kirscht.

Perceived barriers: The potentially negative aspects of particular health action, the perceived barriers, may act as impediments to undertaking the recommended behaviors. A kind of cost benefit analysis is thought to occur where in the individual weighs the action's effectiveness against perceptions that may be expensive, dangerous, unpleasant (e.g., painful, difficult, and upsetting), inconvenient, time consuming, and so forth. Thus, as Rosenstock noted, "The combined levels of susceptibility and severity provided the energy or force to act and the perception of benefits (less barriers) provided a preferred path of action".

Cues to action are other variables that might be internal (e.g., symptoms) or external (e.g., mass media communications, interpersonal interactions, or reminder postcards from health care providers) frequently associated with the HBM. A cue or trigger to action appears to be necessary for an individual to undertake the health related behavior. The intensity of cues needed to trigger preventive actions given a certain level of readiness to engage in such activities is unknown. The general assumption is made that the higher the level of readiness to act, the lower the intensity of the cue needed to trigger behavior. In other words, a negative relationship is postulated between intensity of cue and level of readiness to engage in preventive actions. Cues to action may ultimately prove to be important, but they have not been systematically studied.

Modifying factors proposed in the HBM as affecting predisposition to take preventive action include a variety of demographic such as sex, age, and education,

socio psychological, and structural variables. However, they have had little specific testing in research based on the model.

Part 3 Research About DM

Somsak Katanmongkon, (2000). Study about Factors Affecting the behavior Controlling Blood Glucose Level Among Non Insulin Dependent Diabetes Mellitus(NIDDM) Patients in Bangrakam Distric Phitsanuloke Province: Objective of study to examines the association between the factors were studied and the behavior Controlling Blood Glucose Level Among NIDDM patients. The conceptual framework of study based on Predisposing Reinforcing and Enabling Cause in Education Diagnosis and Evaluation(PRECEDE) Framework and analyze data by regression analysis statistical. The study found the supporting from husband, wife, parent, colleagues, employers and heath personal, perceived susceptibility and pooled perception were the factors that affect on the behavior controlling glucose level among NIDDM patients the most with a predictive and the predictive value of 8.9 percent. For other factors such as predisposing factors as follow by demographic factors, knowledge of diabetes mellitus, perceived severity and perceive advantages of prevention and enabling factors did not significantly associate with the behavior Controlling Blood Glucose Level Among NIDDM patients.

Mark Daniel and Lynne C Messer, (2002): Study about perception of disease severity and barriers to self-care predict glycemic control in aboriginal persons with type 2 diabetes mellitus. The Health belief Model (HBM) was evaluated for secondary prevention of type 2 diabetes mellitus in an Aboriginal population in British Columbia.

Glycemic markers (glycated hemoglobin [HbA_{1c}]), insulin and post-load glucose), diabetes health beliefs (susceptibility, severity, benefits and barriers), knowledge and behavior were measured for 16 men and 18 women with diabetes (age [SD] = 57.7 [11.6]). Eighteen months later, HbA_{1c} and behavior were measured for all participants, and health beliefs obtained for 17 of them. Perceived severity and perceived barriers were related to glycerin status at baseline and follow up, and predicted reduction in HbA_{1c} (ß [SE] [3] 0.40 [0.18], $p < 0.05$). The results support a therapeutic emphasis on belief in the severity of diabetes complications, and the complementary belief that barriers to therapeutic behavior can be overcome in efforts to support Aboriginal persons with diabetes to manage their disease.