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A CLINICAL PROTOCOL FOR THE SCREENING,
DIAGNOSIS, AND MANAGEMENT OF GESTATIONAL
DIABETES MELLITUS BY THE ADVANCED PRACTICE
NURSE IN THE PRIMARY CARE SETTING

Scholarly Project for the Degree of M. S. N.
MICHIGAN STATE UNIVERSITY
ROBIN J. JONES
1997

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By

Robin J. Jones

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ABSTRACT

A CLINICAL PROTOCOL FOR THE SCREENING, DIAGNOSIS, AND MANAGEMENT OF GESTATIONAL DIABETES MELLITUS BY THE ADVANCED PRACTICE NURSE IN THE PRIMARY CARE SETTING

By

Robin J. Jones

Gestational diabetes mellitus (GDM) is the most common complication of pregnancy and represents 90% of diabetes in pregnancy. The purpose of this project was to develop a protocol for the screening, diagnosis, and management of GDM by the Advanced Practice Nurse (APN) in the primary care setting. Starfield's Health Service System Model is the conceptual model used in the development of this protocol. The goal of this protocol is to assist the APN in screening, diagnosing, and managing patients with GDM in the primary care setting. Since there is not a standard protocol for GDM, the APN and other health care providers in primary care will find this protocol beneficial.

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INTRODUCTION

The American Diabetes Association (ADA) (1986), defines Gestational Diabetes Mellitus (GDM) as a carbohydrate intolerance of variable severity whose onset is first recognized in pregnancy. GDM is one of the most common complications of pregnancy, it occurs in 0.15% to 12.33% of pregnancies (Avery, Rossi, 1994). Risk factors for GDM include maternal age over 35, obesity, previous GDM, previous infant weighing over 4,100 grams, previous unexplained fetal demise, family history of diabetes, glycosuria, polyhydramnios and previous birth of a child with a congenital abnormality (Avery, & Ross, 1994). There is also a higher prevalence in women diagnosed with GDM in certain ethnic groups such as African American, Asian-American, Hispanic Americans, Native-Americans, and Pacific Islanders (ADA, 1997).

The most important issues for women diagnosed with GDM are prompt diagnosis and proper treatment. Advances in research have indicated that proper screening, diagnosis and treatment are key elements in the decline of both maternal and fetal morbidity and mortality rates (Gabbe, 1993). In addition to the importance of proper medical management, active participation from the client is vital.

With proper intervention 90% of women diagnosed with GDM will experience minor or no complications (ADA, 1986). Traditionally, all pregnant women diagnosed with GDM were managed

by obstetricians. However, today many primary care physicians as well as Advanced Practice Nurses (APN) are successfully managing women with GDM. Most patients with GDM are readily managed by the primary care provider by prescribing an appropriate diet, encouraging regular exercise, and providing stringent follow-up care with regular self blood glucose monitoring (SBGM) (Jackson, Francke, & Vasilenko, 1996).

The purpose of this project was to develop a protocol for the screening, diagnosis, and management of women with GDM, to be utilized by the APN in the primary care setting. The premise is that achieving glycemic control will optimize the pregnancy outcome, particularly the reduction of stillbirth and macrosomia in GDM (Langer, 1993). Stringent glycemic control allows the achievement of results similar in terms of maternal and fetal health, to those seen in non-diabetic pregnant women. The development of this protocol is based on current research, present intervention and the goals to reduce the risk of fetal malformations and maternal complications. The health care provider's role in managing GDM is invaluable in achieving positive outcome.

Because of the documented success of managing women with GDM, it is of major importance that proper screening and diagnoses be made accurately between 24 to 28 weeks or sooner in high-risk patients. The Advance Practice Nurse (APN) is capable

of providing this care. Essential components of routine practical skills for the APN include early identification and appropriate provisions of care (Griffith & Diguisseppi, 1994). These components coincide with the needs of women with GDM that allows the APN to effectively manage these patients. The APN can also utilize several roles in caring for these patients. The APN's role as assessor, clinician, educator, and collaborator are essential in developing an effective plan of care. By assessing each pregnant woman, a comprehensive health history can reveal actual or potential health risks. As a clinician, the APN can determine on physical exam the health status of the mother and fetus, the fetus' gestational age, and develop a plan of care for continuing obstetrics surveillance (Cunningham, et.al., 1993).

Patient education is one of the most important roles in the care of women with GDM. The APN as an educator is responsible for educating the patient as to the relationship between glycemic control and positive outcome for both mother and fetus. Education is a vital component in encouraging patient's active participation in self-care. The role of collaborator is a critical role for the APN. This role aids the APN in coordinating services and seeking specialized care when needed. The APN can incorporate all roles to ensure prompt detection of risk factors, proper screening and effective diagnosis and management of women with GDM.

This research-based protocol provides decision points for the APN to effectively screen, diagnose, and manage women with GDM in the primary care setting. With dietary modification, and a regular exercise regimen, normal glycemic control can be maintained (Erikson & Lindgarde, 1991). Guidelines for this protocol is based on recommendations from the American Diabetes Association (ADA, 1997) and the American College of Obstetricians and Gynecologist (ACOG, 1986).

Review of Literature

The pathogenesis of gestational diabetes is influenced by the interaction of three main components: beta-cells, that are responsible for providing the insulin that in turn directs how the body metabolizes glucose and the two insulin-sensitive tissues, the liver and the muscles. The two tissues together play critical roles in the maintenance of normal glucose homeostasis. Gestational diabetes pathogenesis is similar to that of Type 2 diabetes. In order for either to develop, two separate malfunctions must be present. First, the beta-cells must have an impairment in insulin secretion. Second, the insulin-sensitive tissues, in particular the liver and the muscle, must be resistant to the effect of the insulin (Langer, 1993).

A hyperinsulinemic state and a decrease in insulin sensitivity is a characteristic of pregnancy; however, the

inability of the target organ to respond to the pregnancy induced insulin changes in and of itself is not sufficient to cause gestational diabetes. A perfectly healthy beta-cell will have the ability to respond and secrete sufficient insulin to offset any insulin resistance. It is only when there is both impairments in the beta-cell secretion and insulin resistance that gestational diabetes occurs (Langer, 1993). When GDM does occur, primary care providers are equipped to manage these patients.

There is no literature available that assesses the management of GDM by the APN in primary care. However, literature was available that supported the family physicians role in managing GDM. Seventy-five percent of patients with GDM can be controlled with dietary therapy, regular exercise and SBGM alone (ADA, 1995c).

In a study done by the Department of Family Practice at Saginaw Cooperative Hospitals, Jackson and his coworkers conducted a study to examine outcomes in women with GDM. The purpose of the study was to determine if similar management practices exist between family practice physicians and obstetricians. A retrospective chart review revealed 813 women as being managed for pregnancy complicated by GDM. The management outcome between the two groups of physicians was compared. The patient groupings were similar in age, health history,

demographics, and diabetes education received. The only exception in similarity was that family physicians cared for a significantly higher percentage of patients on public assistance (60% vs. 38%).

The authors concluded that although there are variations in the care provided to women with GDM by family physicians and obstetricians, there were no significant differences in maternal and neonatal outcome (Jackson, Francke, & Vasilenko, 1996).

Peterson (1994), assessed diabetes care by primary care physicians in Minnesota and Wisconsin. The purpose of the study was to identify the characteristics of diabetes care delivered by primary care physicians. The study involved 27 primary care physicians recruited through the Minnesota Academy of Family Physicians Research Network and the Wisconsin Research Network. A total sample of 240 visits for care of patients with diabetes mellitus was recorded. Seventeen percent of the patients in this study had Type 1 diabetes and 81% had Type 2 diabetes. Fourteen percent of the patients with Type 1 diabetes and 20% of the patients with Type 2 were within their target glucose range. Forty-four percent of primary care physicians rarely referred these patients whereas 20% frequently referred patients to Endocrinologists (Peterson, 1994).

Peterson (1994), concluded in his study that patients who frequently complied to treatment regimen, was able to stabilize

blood glucose values. The challenge for primary care providers is to optimize available resources and to improve glucose control in patients with diabetes in an effort to improve long-term clinical outcomes.

Smits, Paulk and Kee (1995), conducted a two treatment approach study designed to help women with gestational diabetes manage their pregnancies. The researcher compared a hospital outpatient-based nursing intervention and the traditional, office-based care provided by obstetricians. A research model was constructed using three variables: risk factors prior to gestation, conditions that occur during pregnancy and normal versus abnormal outcomes for mother and infant.

Neither treatment approach significantly reduced the risk of abnormal outcomes to mother or infant. First time mothers, patients with GDM on medications and patients with GDM experiencing complications during pregnancy had a significantly greater risk of having an infant with one or more abnormal outcomes. This study supports the importance of maintaining glycemic control throughout pregnancy and the prevention of maternal and fetal complications (Smits, Paulk, and Kee 1995).

Other studies that show how primary care providers have successfully managed patients with diabetes include The Diabetes Control and Complications Trial (DCCT). This ten year multi-center clinical trial sponsored by the National Institutes of

Health (NIH), confirm that there is a direct association with the level of glucose control and the onset and progression of complications in patients with diabetes (DCCT Research Group, 1993). Although this investigation included patients with only Type 1 diabetes the impact of the results is expected to apply to the management of Type 2 diabetes as well (Dawson, 1993 & DCCT, 1993).

This longitudinal study consisted of 1,441 patients; these patients ranged in age from 13 to 39 years at the time of enrollment. These patients had no serious medical conditions such as hypertension, hypercholesterolemia, or severe diabetic complications. The patients were randomized into two groups: a conventional treatment group with a goal to prevent symptoms of hyperglycemia and hypoglycemia. The other group received an intensive therapy treatment with a goal to keep blood glucose as close to normal as possible with a variety of regular insulin regimens whose doses were adjusted at least three times a day based on the results of SBGM. Patients with intensive therapy demonstrated a consistent reduction in microvascular complications when compared to the conventional treatment (Beaser, 1995). The DCCT (1993), recognized that while intensive therapy provided tight glucose control and helped prevent and slow the progression of diabetes complications the initial cost was nearly twice as expensive as conventional therapy. All these

studies support the ability of the primary care provider in managing patients with GDM.

Health care reform focuses on putting care back into the hands of the primary care providers and the community in which they serve. Therefore, in order for the APN to be an affective primary care provider, there must be clear and precise protocols in managing disease processes. Since the APN does not have a standard protocol for GDM in primary care, it is clear that there is a need for the development of a protocol. The purpose of this scholarly project was to develop a protocol for use in the primary care settings by the APN for the screening, diagnosis, and management of women with GDM.

Conceptual Framework STARFIELD'S MODEL

Primary care is the delivery of comprehensive, long-term health care in which the patients have direct access to an appropriate source of care (Starfield, 1992). In primary care, the patient usually initiates entry into the system. In contrast to specialist care, the primary care provider has a long existing established relationship with the patient and its community.

This established provider-patient relationship puts the primary care provider in a better position to assess the impact of social and environmental stressors on the patient's illness (Starfield, 1992).

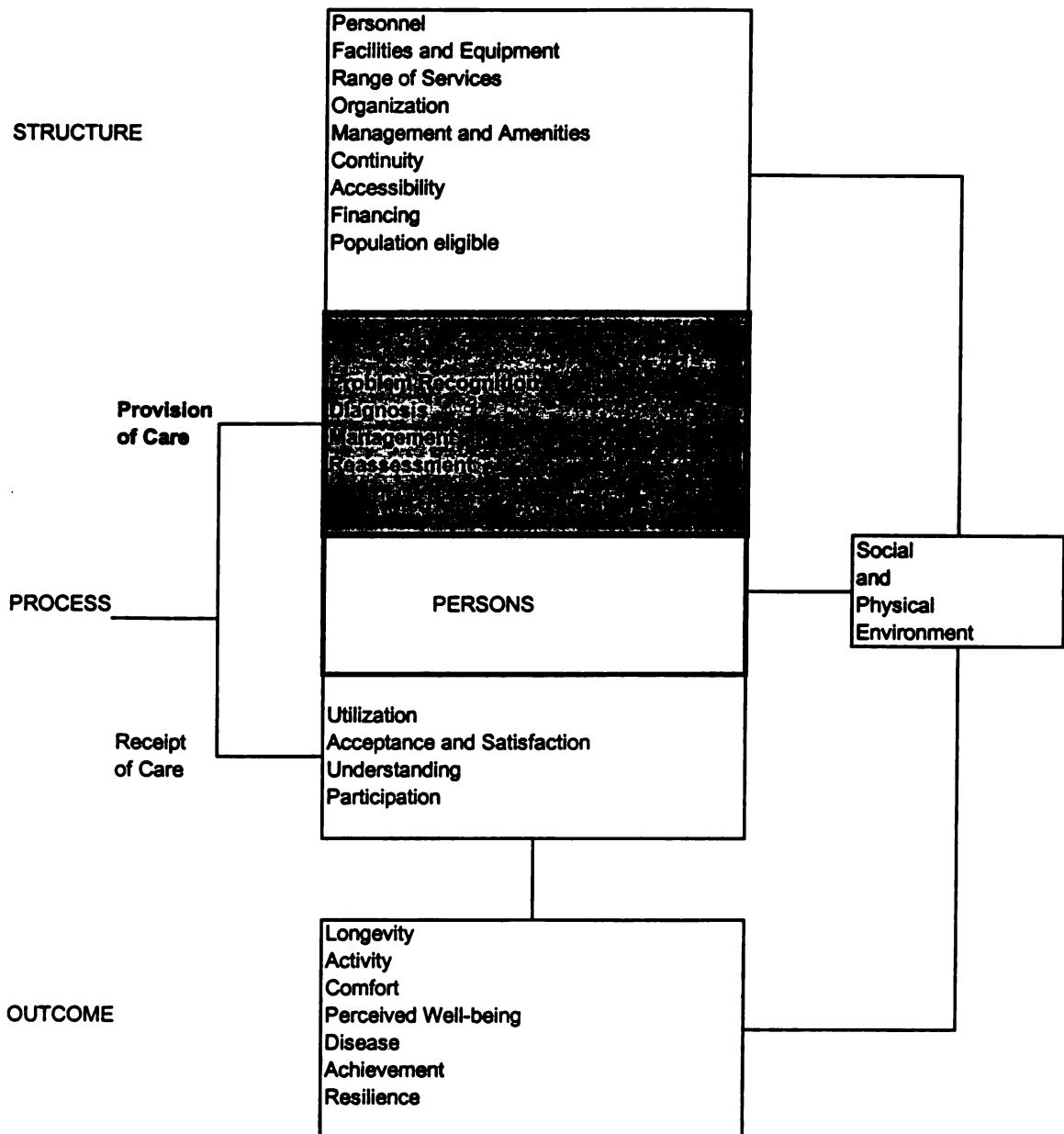


Figure 1: The health service system. Source: Starfield 1973

Primary care providers in primary care acts as the gatekeeper for referrals and coordinating services needed. The characteristics of primary care include longitudinality, first-contact, integration of services and comprehensiveness (Alpert & Charney, 1973; Parker, 1974). Starfield (1992) has identified four factors that effect an individual's state of health. These factors include genetic structure, social and physical environment, individual behaviors and health services. Starfield's framework focused primarily on evaluating primary care and the health system (Figure 1).

The health service system consists of three components: structure (resources needed to provide services), process (how the services are implemented) and outcome (the impact of the health system on the environment). The structure encompasses nine distinct components: personnel, facilities and equipment, range of services, organization, management and amenities, continuity, accessibility, financing, and population eligibility.

The process of the health service system involves two components: those that represent activities of the care providers and those that represent activities of the population being served. The outcome of the care is determined by the impact of care on the health care system. Starfield (1992), has outlined seven components that measure the effects of outcome on the health care system. The most common measure of health is

longevity (normal expectancy/death). Other measures include: activity (functional/disable), perceived well being (satisfied/dissatisfied), comfort (comfortable/uncomfortable), disease (not detectable/asymptomatic, temporary, permanent), achievement (achieving/not achieving), resilience (resilient/vulnerable).

In order for a health care system to be entirely effective for the population being served, it must possess at least some aspect of all of these features.

Because the Starfield Model examines the health system's structure, processes and outcomes to evaluate the services provided to the population for which it serves, it is an excellent model for assessing the needs of women with GDM. For women with GDM, the Starfield model effectively evaluates care provided in the primary care setting. This framework clearly identifies the health care system's structure and process in order to evaluate the system's outcome. The focus of this protocol will address the process portion of the health care system that represents activities of the care provider. The structure and outcome portion will be discussed briefly as it relates to GDM, however for an in-depth discussion they may be assessed individually at a later date.

Structure

Since primary care is the first point of contact with the

health care system (Figure 2), the structure is very important. All features of a high quality health care system must be available. It must be easily accessible in location and in building structure. It is important that all personnel realize that pregnancy is a stressful event. When this event is coupled by a complication such as GDM the stress is greatly enhanced. Genuine care and concern by office personnel promotes an atmosphere for a smooth and positive office visit. The receptionist, who is usually the first contact person, should be pleasant and professional in ensuring that all of the patient's personal information is correct and up-to-date. This information includes any changes in name, address, telephone number or insurance information.

The medical assistant or nurse must be knowledgeable of normal values as well as abnormal values when recording patient information such as blood pressure, blood glucose and results of urine dips. As a clinician in today's every changing health care system, the APN and many other primary care providers are providing care through a network of care providers. To prevent fragmentation of care it is very important that each provider document information accurately and clearly. The provider must be knowledgeable concerning current screening, diagnosis and management as well as research related to GDM. The woman with GDM needs to feel confident that she is receiving efficient and

appropriate care. Because the patient participation in her care is of utmost importance, a strong education component is needed. Women with GDM need to understand basic pathophysiology of the disease as well as how to manage the disease. It is important that these women understand the importance of diet and exercise in managing GDM. The APN's development of an in-office education program will be very beneficial. Referral to a dietitian on initial diagnosis will aid the woman in understanding the dietary food exchange list and the important role that diet plays in managing GDM. The second component in the health care system is process. The process component is the basis of the GDM protocol.

Process

The process (Figure 2) requires input from both the APN and the patient. In order for primary care to be successful, the input from both the APN and the patient must be accurate, legible and continuous. The APN in the role of primary care provider must be knowledgeable of GDM, and those risk factors that may precipitate the need for screening, diagnosis and management. Once the problem has been recognized, the APN must have a full understanding as to how gestational diabetes affects both the mother and the fetus. Management through proper diet, exercise and insulin when needed requires the expertise of an astute clinician. It is important that the APN initiate an in-office diabetes education program so that the patient is able to Insert

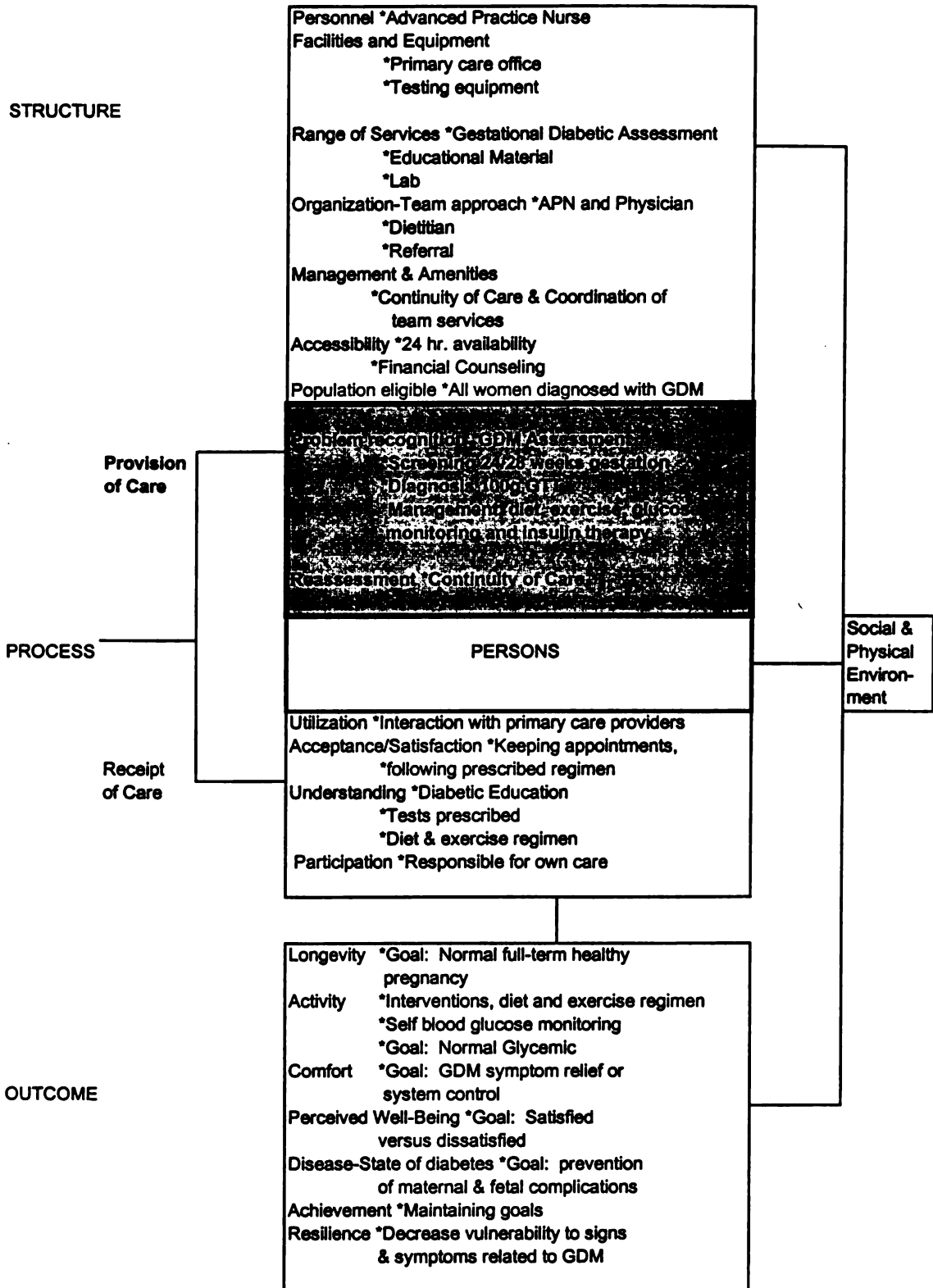


Figure 2: Modified from Starfield, (1973). The health services system.

participate in self-care. The education program will consist of diet, exercise, SBGM, and weekly or bi-weekly visits to the primary care facility.

All these interventions will aid in the early recognition of complications. It is important that care is continuous and appropriate. The patient is more relaxed and compliant when care is continuous. She is more willing to be honest about diet and exercise and more willing to voice her concerns. All these activities require active participation from the patient and she must understand the impact of self-care in determining both maternal and fetal outcome. Once the patient is equipped with knowledge and understands her role in her care, it is then up to her to decide if she is willing to participate. The regimen can be very stringent and may require a strong support system. The woman may need encouragement to follow the diet and exercise regimen, to check her blood sugars often, to keep her appointments and to monitor the fetus's activities. A successful outcome is the basis for establishing the GDM protocol.

Outcome

The GDM protocol outcome, measures of health include: longevity and morbidity; this refers to maternal and fetal complications whose end result may be permanent disability or death, activity; is determined by the patient's willingness to participate in self care behaviors such as the diet and exercise

regimen, comfort; reflects how in tune a patient is in recognizing and managing signs and symptoms of potential complications, such as monitoring fetal activity. Perceived wellbeing is based on the patient's perception of how well she is coping with the stress and management requirements. Disease outcome can be measured by successful progression of pregnancy, management of blood glucose and prevention or early recognition of complications, as indicated and reviewed in the chart. Chart review and assessing patient satisfaction are good measures used in determining quality of care.

GDM is known to be a manageable disease with favorable outcomes for both the mother and the fetus. When gestational diabetes is diagnosed, the APN has an opportunity to help the patient deliver a healthy baby by encouraging patient interventions to maintain optimal glycemic control. Individual patient intervention is based on maintaining near-normal maternal glycemic control (Coustan, 1991).

PROTOCOL DEVELOPMENT

Assessment Protocol/Structure

The goal of this scholarly project was the development of a protocol for the screening, diagnosis, and management of Insert gestational diabetes by the APN in the primary care setting.

Prompt and appropriate management is essential for maternal and fetal health. The overall purpose in managing GDM is

APN in Primary Care
Screening, Diagnosis, and Management of Gestational Diabetes Mellitus

Pre-conceptually not Diabetic

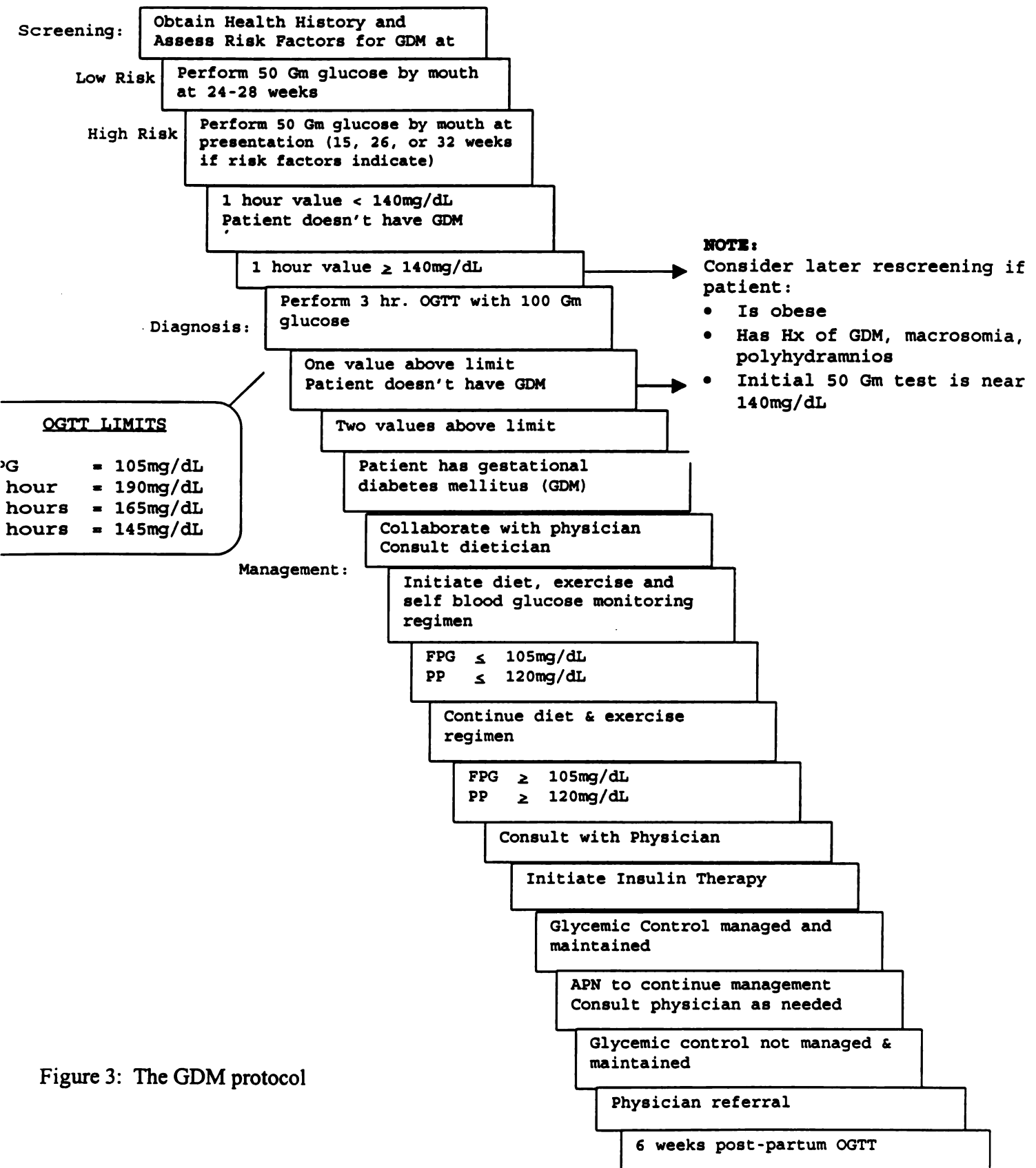


Figure 3: The GDM protocol

directed toward prevention and/or early intervention in treating adverse maternal and fetal outcomes (Coustan, 1991). This protocol is designed to aid the APN in primary care and other providers in establishing glycemic control in women with GDM. The intervention consists of screening, diagnosis and management.

The protocol in (Figure 3) is a reflection of the clinical pathway that is to be utilized by the APN for the screening, diagnosis, and management of GDM. The patient is initially assessed for risk factors for GDM on first contact with the health care system. Screening for GDM begins with the taking of a comprehensive history by the APN.

Health History

The health history is the simplest and one of the most important screening test for GDM (Coustan, 1993). Fifty percent of women will present with known risk factors on assessment of health history (Mulford, Jovanovic-Peterson, & Peterson, 1993). If risk factors are identified anytime during the patients assessment, then early screening at presentation and scheduled intervals at 15, 26, and 32 weeks may be indicated or referral may be required. Studies have shown that women diagnosed early in pregnancy with GDM usually before 20 weeks gestation are more likely to have one or more risk factors, particularly increased maternal age and obesity (Lee-Parritz & Heffner, 1995).

Screening

Women with no known risk factors may be screened later in the pregnancy. Most obstetricians screen all of their pregnant patients for GDM using a 50g one hour glucose challenge at 24 to 28 weeks of pregnancy (Coustan, 1993). In addition to screening women between 24 to 28 weeks the ADA (1997), recommends reevaluating patients between 34 to 38 weeks gestation if the initial screening test is near 140mg/dL, if the woman is obese, has a history of GDM, macrosomia, or polyhydrominas. O'Sullivan (1973) and his colleagues devised the 50g-1-hour challenge test using venous whole blood with a blood glucose threshold of 130mg/dL. However, when the majority of clinical laboratories switched from venous whole blood to venous plasma. The National Diabetes Data Group (1979) proposed that the O'Sullivan criteria be modified since plasma values are approximately 14% higher than are whole blood values. This constituted a need to switch testing to venous plasma that accounts for the 140mg/dL blood glucose threshold.

The ADA (1997) and the ACOG (1986) both recommend a screening threshold of 140mg/dL, this value was arbitrarily arrived at but is now the prevailing standard in the United States. Still, some care providers prefer to use a lower threshold of 130mg/dL. This decision increases the screening test sensitivity. By using this lower threshold, the number of

positive screening tests requiring diagnostic testing would increase from 14% to 23%. Accompanying this increase in positive test would be an approximate 12% increase in overall cost needed to diagnose each case of GDM (Coustan, 1993). The ADA, and the ACOG, supports the 140mg/dL threshold since research does not support any significant differences in outcome by lowering the threshold. The GDM protocol will use the 140mg/dL threshold for screening women for GDM.

Diagnosis

If the venous plasma glucose threshold is less than 140mg/dL then the woman does not have GDM. However, if the venous plasma threshold is 140mg/dL or more, further diagnostic test are indicated (ADA, 1997). An oral or intravenous glucose tolerance test is used in the diagnosis of gestational diabetes. The intravenous glucose tolerance test is more reproducible, however, because of the convenience of the oral glucose tolerance test (OGTT) it is more commonly used. The use of the OGTT is not only more convenient for the client, but it is also a more appropriate means by which nutrients are ingested. By using the oral route of ingestion, gastric as well as pancreatic hormones are brought into play. It should be noted that the OGTT is considered a provocative test rather than a direct parallel test since nutrient intake is not normally in the form of pure glucose (Coustan, 1993).

In the United States, the more commonly used three hour, 100 gram OGTT is used for the diagnosis of GDM. The criteria for diagnosis is based on research conducted by the National Diabetes Data Group (NDDG) which derived values for venous plasma (NDDG, 1979). The requirements for the diagnosis of GDM are that two of the four threshold values be met or exceeded. The decision to require that two values meet or exceed the threshold value was instituted as a safety net to avoid possible mistaken diagnosis of GDM based on a single laboratory finding (NDDG, 1979, ADA, 1997). The acceptable threshold values are as follows:

Fasting	:	105mg/dL
1 hour	:	190mg/dL
2 hours	:	165mg/dL
3 hours	:	145mg/dL

The ADA and the ACOG have both accepted the NDDG criteria for the diagnosis of GDM (ADA, 1997; ACOG, 1986).

Unlike the 50g-1-hour screening test, the 3-hour OGTT is administered in the morning after a fast of 10 to 14 hours. It is recommended that the patient follow an unrestricted diet containing at least 150g/day of carbohydrates for 3 days prior to testing. The basis for an adequate carbohydrate intake is so that the patient will avoid a sluggish response to the glucose challenge and a more abnormal glucose response (Coustan, 1993).

The patient should be allowed to wait in a quiet, relaxed, and smoke-free environment. Eating or drinking other than water is not allowed since the blood glucose will be altered by any

nutrient intake. If a woman is diagnosed as having GDM, then a well-planned management regimen must follow.

Management

The purpose in managing women with gestational diabetes is to establish euglycemia and to avoid hyperglycemia and ketoacidosis. Therefore, a stringent management protocol is necessary. The management plans consist of diet and exercise, SBGM, and obtaining in office blood glucose levels to determine the need for exogenous insulin therapy if needed.

Dietary

The ADA has identified dietary therapy as the cornerstone of management for gestational diabetes. Dietary management alone can successfully treat 75% of women with GDM with no pharmacological therapy (ADA, 1995). Obtaining the help of a dietitian is useful in individualizing the dietary plan. The diet of choice for GDM should include 50% to 55% of mainly complex carbohydrates. Simple sugars intake should be avoided or greatly decreased because of their high absorption rate. The complex high-fiber carbohydrates diet will delay gastric intestinal absorption and may improve the delay in gastric emptying (Schwartz, Phillips, & Langer, 1992). This process will provide a more constant glucose absorption rate. Fat intake should be limited to 20% to 30%, with an increase in polyunsaturated fats, and a decrease in saturated fats and

cholesterol. Protein intake should be restricted to 20% to 30%.

This dietary approach will result in a 15 to 20mg/dL decrease in natural glucose level. (Langer, 1988; Langer, 1991). The daily caloric recommendations for patients with gestational diabetes are based on current weight: (Jovanovic-Peterson & Peterson, 1996).

Current weight less than 80% of ideal body weight	Daily-caloric intake 35 to 40 Kcal/Kg of present body weight
80 to 120% of ideal body weight	30 Kcal/Kg of present body weight
120 to 150% of ideal body weight	24 Kcal/Kg of present body weight
Greater than 150% of ideal body weight	12 to 15 Kcal/Kg of present body weight

In addition to the dietary regimen, exercise has been identified as a primary treatment modality for GDM.

Exercise

Exercise can improve glucose tolerance because hyperglycemia is more an effect of peripheral insulin resistance than insulin deficiency (Weller, 1996). The exact mechanism as to how exercise benefits glucose tolerance is not known. What is known is that for Type 2 diabetes and GDM, increased physical training does increase the sensitivity of insulin. Exercise has shown to lower fasting and post-prandial insulin concentrations and acute glucose levels. Additional benefits of exercise are the

prevention of weight gain, hypertension, hyperlipidemia, increased strength and improved sense of well-being (Jovanovic-Peterson, & Peterson, 1996).

In a study conducted to evaluate types of exercises that would not produce material or fetal complications, the researchers recruited healthy pregnant women to exercise on five types of equipment (Durak, Jovanovic-Peterson, Peterson, 1990). Maternal blood pressure, fetal heart rate and uterine activity were the variables used to evaluate exercise safety in pregnancy. The standard bicycle caused uterine contraction in 50% of cases during 25 sessions. Walking on a treadmill produced no problems, while 40% of 46 women experienced uterine contraction in just 10 sessions when the pace was increased to a jog. A rowing ergometer with the seat fixed where the arms did most of the work had fewer problems. Using this device, 10% of the cases in 68 sessions developed uterine contractions. Using the recumbent bicycle, in 95 sessions lasting a minimum of 20 minutes of cardiovascular workout (target heart rate = $[220 - \text{age}] \times 70\%$), there were no reports of any fetal distress, or uterine activity observed. There were no maternal hypertension and none of the infants born experienced growth retardation. The safest and most accepted modes of exercise were walking on the treadmill, the rowing ergometer and the recumbent bicycle. The study concluded that when exercise is advocated during pregnancy, upper body

exercises or non-weight bearing exercises are considered safest. (Durak, Jovanovic-Peterson, & Peterson, 1990).

These findings suggest that, when little mechanical stress is placed on the trunk region and the lower body is kept from excessive weight-bearing, a woman with GDM can experience a safe cardiovascular workout without fear of fetal distress (Mulford, Jovanovic-Peterson, & Peterson, 1990). It is important to stress to the patient that she must maintain proper hydration during exercise. During pregnancy, it is important to assess the impact of the management program. The patient can actively assess the impact of diet and exercise by doing SBGM.

Self Blood Glucose Monitoring

SBGM for the management of diabetes was first introduced in the late 1970's. Since that time, SBGM has become an essential component in aiding in the management of diabetes. SBGM is now a routine part of the pregnancy regimen. For women with GDM, who are controlled with diet and exercise, one weekly fasting and 2-hour post-prandial blood sugar may be sufficient. Clinical assessment should determine the frequency of SBGM. Until glycemic control has been established and maintained, daily fasting and 2-hour post-prandial glucose monitoring for women with GDM may be indicated, establishing glycemic control is essential (Mahaffey & Podell, 1991). When dietary and exercise therapy fails to achieve euglycemia, accurate and appropriate

insulin administration must be initiated.

Insulin

The ADA (1997), and ACOG (1986), recommends that insulin be initiated to patients when fasting glucose is greater than or equal to 105 when the postprandial glucose is greater than or equal to 120 (ADA, 1997; ACOG, 1986). The APN should consult with the primary care physician until euglycemia has been established. Once normoglycemic control has been established and maintained, the APN can continue the management protocol. The primary care physician should be consulted as needed and kept informed of the patient's progress. The requirement for insulin in GDM is similar to that of patients with Type 2 diabetes. Both categories of patients experience insulin resistance. According to Coustan (1991), it has been his experience that women with GDM experience post-prandial hyperglycemia much more than fasting hyperglycemia. Therefore, these patients respond quite well to insulin therapy consisting of a mixture of intermediate-acting (NPH) and short-acting (Regular) insulins. Insulin should be administered 15 to 45 minutes before breakfast each morning in a ratio of 2:1. Regular insulin for coverage is administered as needed throughout the day (Coustan, 1991). The APN can utilize the in-office educational program to teach the patient proper insulin administration, early identification of signs and symptoms of hypoglycemia and hyperglycemia and the use of glucose

monitoring devices.

In-Office Glucose Monitoring

For the management of GDM, the ACOG and the ADA recommend that fasting plasma glucose be maintained below 105 mg/dL and 2 hour post-prandial values below 120 mg/dL (ACOG, & ADA, 1986). However, a standard of care for daily glucose monitoring has not been determined. There are a number of various approaches used for monitoring glucose levels. The ACOG recommends monitoring fasting and post-prandial glucose values at 2 week intervals (ACOG, 1986). The ADA is less specific about their recommendations for daily glucose monitoring so many providers follow the standard of care for patients with preexisting diabetes. The standard includes daily glucose self-monitoring at various intervals throughout the day (Coustan, 1991). At the Women and Infant's Hospital of Rhode Island, Coustan and his associates recommend that fasting glucose and 2-hour post breakfast and post lunch glucose levels be measured at least weekly. If normal glycemia is not maintained, the patient is either immediately instructed in insulin administration and therapy or started on daily glucose monitoring four to six times per day (Coustan, 1991). Some practitioners prefer a third alternative time which is to bring the patient back within 1 to 2 days for repeat fasting glucose levels (Coustan, 1991). The GDM protocol will individualize in-office glucose monitoring based on

patient's needs and compliance.

IMPLEMENTATION

The APN in primary care will find the GDM protocol very beneficial. The protocol eliminates fragmentation of care. It also increases the ability to monitor the progression of care by early detection and prevention of complications. There are various research opportunities available from the GDM protocol data. The APN could research the population of women with GDM, their ethnicity, geographical location and their reported concerns and complications. Moreover, the researcher can evaluate fetal morbidity and the delivery process.

The tool allows the APN to function in many care provider roles. As an educator, the APN can assess the patient's level of knowledge and increase her knowledge where needed. It is important that the woman understand basic concepts of the disease process, signs and symptoms of hypoglycemia and hyperglycemia, dietary and exercise management and SBGM. When insulin is needed further education is provided.

The cost for screening a woman for GDM is around \$10.00, a relatively low-cost test. However, a diagnosis of GDM may cost several hundred dollars (Moses, Fulwood, Griffiths, 1997). By following the GDM protocol the APN can identify risk factors, appropriately screen, diagnose, and manage women with GDM. This protocol will allow the APN to provide the most cost-effective

care by preventing fragmentation of care. Despite the increase cost needed to care for women with GDM, the cost associated with appropriate managing of GDM is significantly lower than the cost of caring for a mother or fetus, that has been left undiagnosed and untreated.

EVALUATION

This modified model derived from Starfield provides a basis for evaluating women with GDM by utilizing the GDM protocol. The GDM protocol outcomes can be measured by the number of women who maintain glycemic control, by evaluating diabetes education as it relates to management and avoidance of complications and patient satisfaction. The evaluation of the GDM protocol is based on the structure and process of the protocol.

With the use of the protocol, the APN can assess patient satisfaction due to its structure of information for the deliverance of continuity of care. Women with GDM who are placed on the GDM protocol and who actively participate in their care can maintain euglycemia. It is important that these women know up front the importance of diet, exercise, SBGM, prenatal care, and insulin therapy in the prevention or identification of complications. Providing that care providers are consistent in their use of the protocol and charting information, a chart review will be quick and easy while providing significant information.

This user-friendly protocol is an excellent assessment tool for women with GDM. By using a modified model of Starfield, the APN is assured of a structure, process, outcome driven tool.

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