The Diabetes Epidemic In Alabama : An Overview

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Diabetes

- Diabetes affects 29.1 million children and adults in the United States*
  - 9.3% of the population*
  - 26% of patients over age 65 have diabetes**
- Pre - diabetes affects 86 million

Diabetes in Alabama

- Ranks 50th with highest prevalence
- Over 2 year period, prevalence has increased from 11.8 to 13.8% of Alabama population

Etiology of Diabetes

- Complex disease with many causes
  - Characteristics:
    - High blood sugars
- Disorder of metabolism
  - Involves:
    - Food and change from carbohydrates to GLUCOSE

Etiology of Diabetes

- Glucose needed for energy in the cell
- Glucose transported from the bloodstream into the cell via INSULIN

http://www.niddk.nih.gov/health-information/health-topics/Diabetes/causes-diabetes/Pages/index.aspx

Diabetes

- **Group of metabolic disorders that share a common feature of HYPERGLYCEMIA**
  - **Type 1 DM: Absolute deficiency of insulin caused by beta cell destruction**
  - **Type 2 DM: Combination of peripheral resistance to insulin action and inadequate secretory response**

Pathogenesis of Type 1 DM

- **Lack of insulin due to immunologically mediated destruction of the beta cells**
- **Genetic susceptibility: Multiple loci are associated, most commonly MHC class II**
- **The autoimmune insult is chronic by the time the patients first presents**
  - **80 - 90% beta - cell destruction has already occurred**

Pathogenesis of Type 2 DM

- **Environmental factors play a large role (lifestyle, dietary habits, etc.)**
- **Stronger genetic relationship than DM1**
- **Metabolic defects**
  - **Decreased ability of peripheral tissues to respond to insulin**
  - **Beta - cell dysfunction manifested as impaired insulin secretion**

Diagnosis

Table 2.1—Criteria for the diagnosis of diabetes

FPG ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h.*

OR

2-h PG ≥200 mg/dL (11.1 mmol/L) during an OGTT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.*

OR

A1C ≥6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.*

OR

In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dL (11.1 mmol/L).

*In the absence of unequivocal hyperglycemia, results should be confirmed by repeat testing.

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Diagnosis

Table 2.2—Criteria for testing for diabetes or prediabetes in asymptomatic adults

1. Testing should be considered in all adults who are overweight (BMI ≥25 kg/m^2 or ≥23 kg/m^2 in Asian Americans) and have additional risk factors:
   - physical inactivity
   - first-degree relative with diabetes
   - high-risk race/ethnicity (e.g., African American, Latino, Native American, Asian American, Pacific Islander)
   - women who delivered a baby weighing >9 lb or were diagnosed with GDM
   - hypertension (≥140/90 mmHg or on therapy for hypertension)
   - HDL cholesterol level <35 mg/dL (0.90 mmol/L) and/or a triglyceride level >250 mg/dL (2.82 mmol/L)
   - women with polycystic ovary syndrome
   - A1C ≥5.7% (39 mmol/mol), IGT, or IFG on previous testing
   - other clinical conditions associated with insulin resistance (e.g., severe obesity, acanthosis nigricans)
   - history of CVD
2. For all patients, testing should begin at age 45 years.
3. If results are normal, testing should be repeated at a minimum of 3-year intervals, with consideration of more frequent testing depending on initial results (e.g., those with prediabetes should be tested yearly) and risk status.

Complications of Diabetes

Acute Complications

- **Hypoglycemia**
- **Hyperglycemia**
  - **Diabetic ketoacidosis (DKA)**
  - **Hyperglycemic Hyperosmolar Syndrome (HHS)**

Complications of Diabetes

Chronic Complications - Vascular Damage

- Microvascular complications:
  - Neuropathy
  - Nephropathy
  - Retinopathy
- Macrovascular complications:
  - Coronary artery disease
  - Peripheral vascular disease
  - Stroke

Acute Complications: Hypoglycemia

- Hypoglycemia
  - Defined as blood sugar < 70 mg/dL
- Treat with Rule of 15
  - 15 grams of carbohydrates every 15 minutes until blood sugar above 70
  - Then follow with snack (carb + protein or carb + fat) to prevent recurrence

Acute Complications: Hypoglycemia

- Prescribe glucagon injections for those at high risk for severe hypoglycemia
- Repeated hypoglycemic episodes warrants provider visit or treatment adjustment

Helpful Hints for Diabetic Ketoacidosis

- D - dehydrated
- K - ketotic/ ⇑ K+
- A – acidotic

- DKA due to 5 I's:
  - Infection
  - Ischemia
  - Infarction
  - Intoxication
  - Ignorance

Helpful Hints for Hyperglycemic Hyperosmolar State

- Precipitating factors
- Coexisting diseases (acute heart attack, hormone producing tumors, stroke, Cushing's syndrome, hyper and hypothermia, renal failure, pancreatitis, burns, thyrotoxicosis)
- Infection (cellulitis, pneumonia, sepsis, UTI)

Helpful Hints for Hyperglycemic Hyperosmolar State

- Medications (glucocorticoids, loop diuretics, chemo agents, calcium channel blockers)
- Undiagnosed Diabetes

Hyperglycemic Emergencies

- Diabetic Ketacidosis
  - Diagnostic criteria
    - Increased anion gap (> 17 mEq/L) and high or high normal serum osmolality (>280 mOsm/L)
  - Other important lab changes
    - Arterial or venous pH <7.3
    - PCO2 <40mmHG (metabolic acidosis)

Hyperglycemic Emergencies

- HCO3 <15 mEq / L
  - Hyperglycemic Hyperosmolar State
    - Diagnostic criteria
      - Elevated BS usually > 600
      - High serum osmolality
      - BUT Normal anion gap
      - pH >7.3

Prevention is the Key to Acute Complications

- Avoid hypoglycemia
  - Eat regularly
  - Check blood sugar before exercising
  - Treat with Rule of 15
  - Consult health care provider if repeated occurrences or unawareness of low blood sugar

Prevention is the Key to Acute Complications

- Try to avoid hyperglycemia
  - Follow diet plan
  - Take meds
  - Follow Sick Day Rules

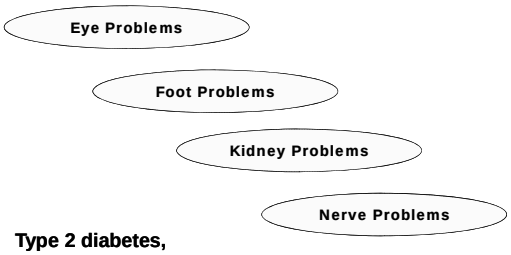
Pathophysiology of Chronic Complications

- Macrovascular Complications
  - Main cause of mortality
  - Large and medium vessel disease due to accelerated atherosclerosis

Pathophysiology of Chronic Complications

- Microvascular Complications
  - Significant source disability and decrease in quality of life
  - Capillary dysfunction in target organ

Microvascular Complications



Type 2 diabetes,
the metabolic syndrome
and cardiovascular disease
in Europe

Diabetic Retinopathy

- Diabetes is the most common cause of blindness in the United States
- Highest correlation with severity of diabetes
- The prevalence increase with the duration of the disease (few within 5 years, 80 - 100% will have some form of DR after 20 years)
- Glaucoma and cataracts occur earlier and more frequently in people with diabetes

Diabetic Retinopathy

- Diabetic retinopathy refers to all disorders of the retina caused by diabetes
- There are 2 major types of retinopathy:
  - Non-proliferative
    - This is the common, mild form
  - Proliferative
    - This form is much more serious

Diabetic Retinopathy

- Risk Factors
  - Diabetes duration
  - Chronic hyperglycemia
  - Nephropathy
  - Hypertension
  - Dyslipidemia

Diabetic Retinopathy

Screening

- To prevent loss of vision and to intervene with treatment when vision loss can be prevented or reversed
  - Type 1 Diabetes - Initial dilated eye exam within 5 years after the diagnosis of diabetes

Diabetic Retinopathy

- Type 2 Diabetes- Initial dilated eye exam at the time of diagnosis
- Retinal photography may serve as a screening tool but is not a substitute for comprehensive eye exam

Diabetic Retinopathy

- Treatment
  1. Laser Photocoagulation - High risk proliferative diabetic retinopathy
  2. Intravitreal injections – Anti - vascular endothelial growth factor for diabetic macular edema

Diabetic Nephropathy

- Affects 20 - 40% of patients with diabetes
- Kidneys act as filters and remove waste products from the blood
- Protein and red blood cells are too big to pass through the filter and remain in the blood
- High levels of blood sugar can put extra stress on the kidneys
- After years of damage, the kidneys start to leak

Diabetic Nephropathy

- Useful proteins are lost in the urine
- Leads to a condition known as microalbuminuria
  - There are several treatments at this point that may keep the kidney disease from getting worse

Diabetic Nephropathy

- When kidney disease is diagnosed later, during macroalbuminuria, end-stage renal disease (ESRD) usually follows
- ESRD
  - Kidney transplant or
  - Regular visits to a dialysis clinic

Screening

- Annual assessment of urinary albumin (spot urine albumin - to - creatinine ratio) and estimated glomerular filtration rate patients with:
  - Type 1 diabetes > 5 years
  - Type 2 diabetes
  - Comorbid Hypertension

Management

- Optimize glucose control
- Optimize blood pressure control (< 140 / 90)
- For non - dialysis - dependent patients, dietary protein intake should be 0.8g / kg body weight per day

Management

- ACE inhibitor / Angiotensin receptor blocker recommended for patient with modestly elevated urine albumin excretion
- Referral for evaluation for renal replacement treatment in advanced kidney disease

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Diabetic Neuropathy

- Sensorimotor neuropathy
- Autonomic neuropathy
- Mononeuropathy
- Proximal motor neuropathy

Sensorimotor Neuropathy

- Patients may be asymptomatic
- Early symptoms caused by small fiber involvement - pain and dysthesias
- Large fiber involvement causes numbness and Loss of Protective Sensation
- In diabetic patients sensory neuropathy usually predominates

Diabetic Neuropathy

- Screening
  - Type 1 diabetes > 5 years
  - Type 2 diabetes
- Assessment should include - 10g monofilament testing and at least one of the following tests:
  - Pinprick, temperature or vibration sensation

Diabetic Neuropathy

- Treatment
  - Optimize blood sugar control
  - Medications

Foot Care

The combination of nerve damage and insufficient blood supply in the legs and feet of people with diabetes often leads to painful ulcers, infection and gangrene. This can ultimately result in amputation and even death.

Type 2 diabetes, the metabolic syndrome and cardiovascular disease in Europe

Foot Care

- Risk Factors
  - History of foot ulcer
  - Amputation
  - Foot deformities
  - Peripheral neuropathy with Loss of Protective Sensation
  - Pre - ulcerative callus or corn

Foot Care

- PAD
- Poor glycemic control
- Visual impairment
- Diabetic nephropathy (Especially patients on dialysis)
- Cigarette smoking

Foot Care

- Evaluation for Loss of Protective Sensation
  - Comprehensive foot evaluation each year
- Evaluation for Peripheral Arterial Disease
  - Patients with signs / symptoms
  - Patients with additional risk factors

Foot Care

Patient Education

- Good blood sugar control
- Check feet every day
  - For cuts, blisters, red spots, swelling
  - Use a mirror to check the bottoms of the feet

Foot Care

- Wash feet every day in warm (not hot) water
  - Dry well, especially between the toes
- Keep feet soft and smooth
  - Use thin coat of lotion on the tops and bottoms of feet
  - Do not use lotion between your toes

Foot Care

- Trim toenails weekly
  - Trim straight across
  - File edges with an emery board

Foot Care

- Stop smoking to improve blood flow to your feet
- Wear Shoes and Socks at All times
  - Never walk barefoot
  - Wear comfortable shoes that protect feet
  - Feel inside of your shoes before putting them on to make sure lining is smooth and no objects are inside

When To See The Podiatrist

- If you cannot reach or see well enough to cut your own nails
- If your toenails are too thick for you to cut
- If you have thick callouses
- If you have now or have ever had a foot ulcer
- If you have numbness in your feet

Macrovascular Complications

- Coronary Artery Disease
  - 2 - 4 times increased risk compared to general population
  - Greater incidence of “Silent MI”
    - Likely due to sensory neuropathy
    - May present as CHF

Macrovascular Complications

- Peripheral Vascular Disease
- Cerebrovascular disease

Macrovascular Complications

- Cardiovascular risk factors should be systematically assessed annually:
  - Smoking
  - Hypertension
  - Dyslipidemia
  - Family history of premature coronary disease
  - Presence of albuminuria

Hypertension

- Systolic blood pressure goal < 140
- Diastolic blood pressure goal < 90
- Lifestyle modification for BP > 120/80
- Pharmacological therapy for confirmed office - based blood pressure > 140/90

Hyperlipidemia

- **Lipid profile at the time of diagnosis**
- **Lifestyle modification**

Anti - Platelet Therapy

- **Primary prevention in Diabetics at increased cardiovascular risk (10yr risk > 10%)**
- **Secondary prevention in those with diabetes and a history of atherosclerotic cardiovascular disease**

Table 5.2 - Summary of Glycemic Recommendations for Nonpregnant Adults with Diabetes

A1C	<7.0% (53 mmol/mol)*
Preprandial capillary plasma glucose	80–130 mg/dL* (4.4–7.2 mmol/L)
Peak postprandial capillary plasma glucose†	<180 mg/dL* (10.0 mmol/L)

*More or less stringent glycemic goals may be appropriate for individual patients. Goals should be individualized based on duration of diabetes, age/life expectancy, comorbid conditions, known CVD or advanced microvascular complications, hypoglycemia unawareness, and individual patient considerations.
†Postprandial glucose may be targeted if A1C goals are not met despite reaching preprandial glucose goals. Postprandial glucose measurements should be made 1–2 h after the beginning of the meal, generally peak levels in patients with diabetes.

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Lifestyle Management for Diabetes

Lifestyle Management: Diet and Activity

- **Promote healthy eating with variety of foods and proper portion size**
- **Maintain a healthy weight**

Lifestyle Management: Diet

- **Diet**
  - **Dietary guidelines for those with diabetes**
- **Focus on dietary pattern intake rather than individual nutrients**
- **Avoid extremes of nutrients (Associated with adverse outcomes)**

American Diabetes Association. (2016). Standards of medical care in diabetes -2016. *Diabetes Care, 39*(1), S 23-35

Lifestyle Management: Diet

- Very low protein diets lead to malnutrition
- Excessive protein intake leads to increased albuminuria, kidney function loss, and cardiovascular risk
- High fat (more than 30%) leads to hypercholesterolemia and cardiovascular risk

American Diabetes Association. (2016). Standards of medical care in diabetes -2016. *Diabetes Care, 39*(1), S 23-35

Diet: Protein Intake

- Protein increases insulin response without an increase in glucose levels
  - Never use to treat hypoglycemia alone
  - But may help insulin's response to carbs

Diet: Protein Intake

- American Diabetes Association (2016) recommends:
- Intake of 0.8 g/kg body weight per day:
  - For nondialysis diabetes patients
  - For diabetes patients with glomerular filtration rate (GFR) < 30 mL/min/1.73 m2

Diet: Protein Intake

- Avoid protein intake > 1.3 g/kg/day in adults with chronic kidney disease

National Kidney Foundation. (2007). KDOQI Clinical practice guidelines and clinical practice recommendations for diabetes and chronic kidney disease. *Am J Kidney Dis, 49(2),* S12-S154

Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. (2013). KDIGO 2012 Clinical practice guideline for the evaluation and management of chronic kidney disease. *Kidney Int, 3,* S1-S150

American Diabetes Association. (2016). Standards of medical care in diabetes -2016. *Diabetes Care, 39*(1), S 23-S35

Diet: Carbohydrate Intake

- American Diabetes Association (2016) recommends:
- Choosing carbohydrates from fruits, vegetables, whole grains, dried beans, and dairy products instead of concentrated sweets and liquid calories

Diet: Carbohydrate Intake

- Choose high fiber
- Sugar - sweetened drinks and low fat or no fat products avoided

Diet: Carbohydrate Intake

- Consistent carbohydrate diet is recommended
  - Consistent time
  - Evenly spaced meals
  - Consistent in amount
- **Helps in improving blood sugar and reducing the risk of hypoglycemia

Diet: Carbohydrate Intake

- Maintenance of weight for a moderate sized man: 60 - 75 grams of carbohydrates per meal (4 - 5 servings where 1 serving = 15 grams)
  - Less if weight loss desired

Diet: Carbohydrate Intake

- Maintenance of weight for a moderate sized woman: 45 - 60 grams of carbohydrates per meal (3 - 4 servings where 1 serving = 15 grams)
  - Less if weight loss desired

Diet: Carbohydrate Intake

- Alcohol
  - Only in moderation
    - 1 drink / day for women
    - 2 drinks / day for men
  - May cause delay hypoglycemia

Diet: Fat Intake

- American Diabetes Association (2016) recommends:
  - 20 - 35% of calories
  - Type of fat is most important (Avoid trans fats)
  - Tailoring amount individual with patient's CV risk in mind but consistent with general public recommendations

Diet: Fat Intake

- Discussed potential benefits obtained from Mediterranean diet
  - Diet high monounsaturated fats
  - Foods rich in omega - 3 fatty acids (Fatty fish and some nuts / seeds)

Diet: Sodium

- American Diabetes Association (2016) recommends:
  - Limiting consumption to 2300 mg / day
  - If hypertension, consider limiting to 1500 mg / day

American Diabetes Association. (2016). Standards of medical care in diabetes -2016. *Diabetes Care, 37*(1), S 23- S56.

Applying Recommendations Into a Dietary Pattern of Intake

- Mediterranean diet
  - Plant - based foods (e.g., fruits and vegetables, whole grains, legumes and nuts)
  - Olive oil instead of butter
  - Herbs and spices instead of salt
  - Limiting red meat (few times a month)

Applying Recommendations Into a Dietary Pattern of Intake

  - Fish and poultry at least twice a week
- Dietary Approaches to Stop Hypertension
  - Consistent carbohydrate for patients using insulin

Applying Recommendations Into a Dietary Pattern of Intake

- AVOID traditional Western diet (rich in animal protein, fat, sodium, sugar, and calories) due to worsening of macrovascular and microvascular complications

Lifestyle Management: Activity

- Clinical trials provide strong evidence for activity lowering A1c
- Adults over age of 18
  - Exercise 150 minutes / week of moderate intensity
  - Or exercise 75 minutes / week of vigorous intensity

Lifestyle Management: Activity

  - Include resistance training 2 days / week (unless not indicated)
    - Free weights or weight machines
    - Sessions = 1 set of 5 or more resistance exercises involving large muscle groups

American Diabetes Association. (2016). Standards of medical care in diabetes -2016. *Diabetes Care, 37*(1), S 23- S56.

Lifestyle Management: Activity

- Adults over 65 with disabilities
  - Stay as active as possible
    - Stand and move at least every 90 minutes
- Evaluate patients individually
- Assess cardiovascular risk

American Diabetes Association. (2016). Standards of medical care in diabetes -2016. *Diabetes Care, 37*(1), S 23- S56.

Obesity Management

- BMI should be calculated and documented
- Diet, physical activity, and behavioral therapy to achieve 5% weight loss should be prescribed for overweight and obese patients with type 2 diabetes
- Strategies to achieve a 500 - 750 kcal/day energy deficit

Diabetes Pills

Oral Medications

Anti-Hyperglycemic Therapy

- Oral agents and non-insulin injectables:
  - Metformin
  - Sulfonylureas
  - Thiazolidinediones
  - DPP-4 inhibitors
  - SGLT-2 inhibitors
  - GLP-1 receptor agonists

Meglitinides
a-glucosidase inhibitors
Colesevelam
Dopamine-2 agonists
Amylin mimetics

Factors to Consider When Choosing Pharmacological Agent(s) for Diabetes

- Current A1c
- Duration of diabetes
- Body weight (BMI, abdominal obesity)
- Age of patient
- Co-morbidities
- Cost of medication
- Convenience

Metformin

Action	Decreases hepatic glucose production
Advantages	• Extensive experience • No hypoglycemia • Low cost
Disadvantages	• Gastrointestinal side-effects • Avoid in patients with: CKD, • Lactic acidosis risk (rare; occurs when too much lactate in blood and a low pH; carries 50% mortality)

Sulphonylureas

Action	Increased insulin secretion
Advantages	• Potent glucose lowering effect • Extensive experience • Low cost
Disadvantages	• Hypoglycemia • Weight gain

TZDs

Action	Increase insulin sensitivity
Advantages	• No hypoglycemia • Increase HDL • Decrease Triglycerides • Low cost
Disadvantages	• Weight gain • Edema / heart failure

DPP - 4 Inhibitors

Action	Increase insulin secretion Decrease glucagon secretion
Advantages	• No hypoglycemia • Well tolerated
Disadvantages	• Angioedema/urticarial • ? Acute pancreatitis • High cost

GLP-1 receptor agonists

Action	Increase insulin secretion Decrease glucagon secretion Slow gastric emptying Increase satiety
Advantages	• No hypoglycemia • Weight lowering effect • Decreased after meal glucose excursions
Disadvantages	• Gastrointestinal side-effects • ? Acute pancreatitis • Thyroid tumors in animals • Injectable • Training requirements • High cost

SGLT-2 Inhibitors

Action	Blocks glucose reabsorption by the kidney, increasing glucosuria
Advantages	• No hypoglycemia • Weight lowering effect • Effective at all stages of Type 2 diabetes
Disadvantages	• Genitourinary infections • Polyuria • Volume depletion • Increased LDL • Increased creatinine (transient) • DKA • High cost

The Goal of Insulin Therapy

- Administration of insulins are arranged to mimic the normal basal, prandial and post - prandial secretion of insulin
- Short acting forms are usually combined with longer acting preparations to achieve this effect

"Meal" Insulins

HumulinR®

NovolinR®

- Short-acting
- Inject these 30 minutes before meals
- May last a couple of hours too long, so that blood sugar is too low after effect of meal wears off

"Meal" Insulins

Novolog®

Humalog®

Apidra®

- Rapid-Acting
- Inject these 15 minutes before meals
- Can inject right before meal or immediately after finishing meal
- They wear off faster and are less likely to cause low blood sugar between meals

Intermediate - Acting Insulins

- Novolin N®, Humulin N®
  - Cloudy
  - Lasts about 12 - 18 hours
  - Inject these at consistent times
  - Usually taken twice a day

Long-acting Insulins

- Lantus®
  - Longer acting, usually taken once a day at same times
- Levemir®
  - Long acting, taken once or twice a day
- Newer long - acting insulins
  - Toujeo
  - Tresiba

Insulin "Mixes"

- Cloudy
- Usually taken twice a day with meals
- Difficult to obtain good control with mixes due to low blood sugar risks
- Depend on very consistent meal patterns

Insulin "Mixes"

- Humulin 70 / 30, Novolin 70 / 30
  - Mixtures of 70% NPH and 30% regular insulin
- Humalog Mix 75 / 25
  - Mixture of 75% longer - acting and 25% fast - acting insulin
- Novolog Mix 70 / 30
  - Mixture of 70% longer - acting and 30% fast - acting insulin

Insulin Administration

- **Pick injection site:**
  - **Anywhere on belly at least 2 inches away from belly button**
  - **Outer thighs**
  - **Backs of arms**

Insulin Administration

- **Pinch skin, hold needle like a pencil, and inject at a 45 to 90 degree angle**
- **Rotate injection sites**
  - **Next injection should be at least 2 inches from where last injection was given**

Indications for Insulin Pump Therapy (Continuous Subcutaneous Insulin Infusion)

- Inadequate glucose control OR A1c >7% with MDI regimen
- Recurrent Hypoglycemia
- Nocturnal Hypoglycemia
- Hypoglycemia unawareness
- Preconception and Pregnancy
- Recurrent Diabetic Ketoacidosis
- Patient preference
- Meal-timing flexibility

Key Concepts

- **Basal Infusion - Provides continuous insulin infusion to mimic the pancreas in the fasting state**
- **Carbohydrate Ratio or Meal Bolus - The number of carbohydrate grams covered by 1 unit of insulin**
- **Insulin Sensitivity Factor - Blood glucose (mg/dl) that is lowered by 1 unit of insulin**

Characteristics of the Ideal CSII Candidate

- Patient with T1DM or intensively managed insulin-dependent T2DM
- Currently performing ≥ 4 insulin injections and ≥ 4 SMBG measurements daily
- Motivated to achieve tighter blood glucose control
- Willing , intellectually, and physically able to undergo the rigors of insulin pump therapy initiation and maintenance
- Willing to maintain frequent contact with their health care team

CSII: continuous subcutaneous insulin infusion
T1DM: type 1 diabetes mellitus
T2DM: type 2 diabetes mellitus
SMBG: self-monitored blood glucose

Advantages of Pump Therapy

- **Improved blood glucose control**
- **Precise dosage delivery**
- **Improved control for pre - conception and pregnancy**
- **Increased flexibility in lifestyle**
- **Improved control during exercise**