

# **EVALUATION OF GLUCOSE MONITORING TECHNOLOGIES FOR COST EFFECTIVE AND QUALITY CONTROL/MANAGEMENT OF DIABETES**

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# What Is Diabetes?

- **a metabolic disease: a disorder of how the body uses food**
  - Normally, the pancreas produces insulin, which allows blood glucose to be metabolized
  - In individuals with diabetes, the pancreas produces either insufficient or no insulin, or the body's cells do not respond correctly to the insulin which is produced.

# What Is Diabetes?

- **Three types of diabetes**
  - **Type 1 (formally called juvenile diabetes)**
  - **Type 2 (formally called adult onset diabetes)**
  - **Gestational diabetes**

# What Is Diabetes?

- **Type 1 (juvenile)**
  - **5-10% of diagnosed cases in U.S.**
  - **Mostly children, but also adults**
  - **Cause: body attacks insulin-producing cells**
  - **If not treated, results in death**

# What Is Diabetes?

- **Type 2 (adult onset)**
  - **90-95% of diagnosed cases in US**
  - **often associated with**
    - **older age (but occurring more frequently in children and adolescents)**
    - **obesity**
    - **family history of diabetes**
    - **previous history of gestational diabetes**
    - **physical inactivity**
    - **certain ethnicities**

# What Is Diabetes?

- **Type 2 (adult onset)**
  - **Usually pancreas produces insulin, but body is unable to use it effectively**
  - **Incidence (2010): 25.8 million adults over 20 (another 7.1 million undiagnosed)**
  - **Incidence expected to double between 2005 and 2050**
  
  - **Clearly a significant and growing problem: 7<sup>th</sup> leading cause of death in U.S. in 2010**

# Traditional Technology

- **the traditional way to check blood sugar levels is for the patient to:**
  - **(1) prick the finger with a small, sharp needle**
  - **(2) transfer the drop of blood to a test strip**
  - **(3) place the test strip into a glucose meter**
  - **(4) read the blood glucose level displayed on the meter**

# Traditional Technology

- **Lack of adherence is generally due to**
  - **the inconvenience of testing multiple times daily**
  - **the cost of monitoring supplies**
  - **the pain associated with multiple finger pricking**
- **While the glucose meter is relatively inexpensive (~ \$40, test strips can cost up to \$100/mo**

# **A New Technology: Continuous Glucose Monitoring**

- **CGMS include a tiny sensor that is surgically inserted under a diabetic's skin and used to monitor glucose levels**
- **The sensor can stay in place for up to one week**
- **Glucose levels are transmitted via radio waves to a wireless monitor**

# **A New Technology: Continuous Glucose Monitoring**

- **Unlike conventional SMBG monitoring, CGMS devices have the ability to more easily identify trends and fluctuations regarding direction, duration, magnitude, and frequencies in blood glucose levels that are difficult to monitor effectively using traditional glucose monitoring methods**

# CONTINUOUS GLUCOSE MONITORING CLINICAL RESULTS

- **Benefits of CGM: Type 1 Diabetes**
  - **greater improvement in A1C levels**
  - **patients using CGM were more satisfied with their treatment and had better quality of life**
  - **a review of 14 randomized clinical trials found that real-time CGM had a favorable effect on blood glucose control and decreased the incidence of hypoglycemic episodes in both adult and pediatric patients**

# CONTINUOUS GLUCOSE MONITORING CLINICAL RESULTS

- **Benefits of CGM: Type 2 Diabetes**
  - **fear of hypoglycemia was lower**
  - **when used on an intermittent basis, showed significant decreases in calorie consumption, an increase in exercise time and a decrease in the HbA1c levels**
  - **Many studies showed decreased A1C levels**

# CONTINUOUS GLUCOSE MONITORING: BARRIERS TO ADOPTION

- **task of inserting and calibrating the sensor was complex, as was troubleshooting device malfunctions, and responding to alarms**
- **many patients experience pain and/or discomfort from the sensor, transmitter, or tapes which are used to secure the device to the body**
- **reimbursements for CGM devices have been limited by insurance or government payers**

# **CONTINUOUS GLUCOSE MONITORING: COST EFFECTIVENESS**

- **in type 1 diabetics, patients using CGMS achieved an expected improvement in effectiveness of 0.52 QALYs; based upon a willingness-to-pay of \$100,000/QALY, CGM with intensive insulin therapy was deemed to be cost effective**
- **In type 2 diabetics, improved glycemic control from CGMS was projected to reduce average costs with the following complications: heart disease (-\$177), kidney disease (-\$141), and diabetic food complications (-\$212)**

# DISCUSSION

- **CGM appears to be is a viable treatment option that assists in data collection for lifestyle and treatment adjustments**
- **Clinically, in multiple studies, CGM has been shown to be effective in reducing blood glucose and HgA1c**

# DISCUSSION

- **CGMS technologies are able to detect critically low overnight blood glucose levels, reveal blood glucose change levels between meal consumptions, display early morning spikes in blood glucose, and evaluate how an individual's caloric intake and physical activity affect blood glucose levels**
- **They offer potential to predict hypoglycemic events before their occurrence and are compact, and light-weight**
- **CGMS are especially useful in ICUs, where close monitoring of blood glucose is especially important**

# DISCUSSION

- **Problems to overcome:**
  - **most commercially-available CGMS require training and education of the diabetic patient, and frequent fingerstick blood tests for calibration**
  - **They are also relatively expensive**
- **According to WebMD, new and improved types of CGMS are currently in clinical trials**