Past, Present & Future of Insulin Management
The Sweet Salvation of Safe and Effective Glycemic Control

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Objectives

• Understand the presentation of diabetes and its various complications and comorbidities.
• Review oral agents that affect insulin secretion.
• Discuss appropriate introduction and titration of insulin therapy.
• Outline strategies to eliminate the use of sliding scale insulin.
Diabetes in the US

• 25.6 million adult cases in 2010 with 1.9 million new cases

• 20% of patients over age 65, and growing.

• In a study by Sinclair, 15% of LTC residents have diabetes with an additional 30.2% having impaired glucose tolerance.

• 1 in 10 US Healthcare dollars is spent on diabetes and its complications.

White BA et al. Annals of Long Term Care August 2009; 42 -
Distribution of Costs

<table>
<thead>
<tr>
<th>Breakdown of costs</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital in-patient care</td>
<td>43%</td>
</tr>
<tr>
<td>Medications to treat complications</td>
<td>18%</td>
</tr>
<tr>
<td>Diabetic medications and supplies</td>
<td>12%</td>
</tr>
<tr>
<td>Physician office visits</td>
<td>9%</td>
</tr>
<tr>
<td>Nursing home care</td>
<td>8%</td>
</tr>
</tbody>
</table>

Total annual cost per patient | $13,700

Reid T.; J of Managed Care Med; Vol 17. No. 1; 2014
Diabetes in Long Term Care

• According to MDS data, prevalence is 26.4%.
• There are undiagnosed cases.
• More challenging to manage than any other chronic medical condition.
• Challenges every fiber of physical, psychological, social, and spiritual well-being.
• It takes a “village” consisting of the entire interdisciplinary team to write a success story.
Risk Factors

• Family history: 1\textsuperscript{st} degree relative
• Gestational diabetes or birth weight > 9 lbs
• Polycystic ovary syndrome (PCOS)
• Obesity (BMI 25+) and visceral adiposity
• Hypertriglyceridemia or low HDL
• Ethnicity: African American, Latino, Native American, Asian, and Pacific Islander
• Sedentary lifestyle
• Genetic factors: 50% concordance in monozygotic twins
Natural History of Insulin Resistance

- Increase in insulin resistance.
- Increase in endogenous insulin in response to rising FPG and PPG.
- Increased hepatic glucose production in response to energy deprived cells.
- Diagnosis somewhere in a 3 year window (grey box) after macrovascular damage has started.

Pre-Diabetes

Frank Diabetes Mellitus

<table>
<thead>
<tr>
<th>Severity of Diabetes</th>
<th>Pre-Diabetes</th>
<th>Frank Diabetes Mellitus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin Resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatic Glucose Production</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endogenous Insulin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postprandial Blood Sugar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fasting Blood Sugar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endogenous Insulin</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Microvasular Complications

Macrovasular Complications

Time (Years) 4-7 years "Diagnosis of Diabetes"

Profile of the Elder Diabetic

• Decreased functional abilities with increased risk for falls.
  – 78% fall rate in residents with diabetes compared to 30% for those without.

• Increased ER visit and Hospital admission rates.
  – 43% of patients with diabetes compared to 25% of the control group.

• Increased rates of depression
  – Ranging from 18.7% to 66% in those with diabetes compared to 33% rate for all NH residents.

White BA et al. Annals of Long Term Care August 2009; 42 - 46
Profile of the Elder Diabetic

• Cognitive function impairment that correlates to level of HgA1c.
  – In 1 study, HgA1c level < 6% was found to have a deteriorating affect on cognition.
  – HgA1c 6% - 8% had higher MMSE scores than study participants under 6% or over 8%.
  – Conclusion: HgA1c levels 7.5% - 8.0% may represent acceptable levels of control for an elderly diabetic.

White BA et al. Annals of Long Term Care August 2009; 42 -
Complications of Diabetes Mellitus

Patients with Type II DM more than 10 years are 3 times more likely to have an ischemic stroke than those without DM.

Retinopathy is estimated to occur in approximately 30% of all diabetics with a slightly higher prevalence in men.

20%–40% will develop diabetes-related renal disease.

8-fold increased risk for Lower limb amputation.

Neuropathy is estimated to occur in at least 10% of the diabetic population.
Hyperglycemia
Potential Presentations in the Elderly

• Blurred vision
• New or worsening confusion
• Lethargy
• Polydipsia
• Polyphagia
• Worsening incontinence
When patients and health care providers were questioned about their feelings regarding Insulin therapy, the most prevalent fear expressed was?
Hypoglycemia
Potential Presentations in the Elderly

- Altered mental status
- Behavior disturbance
- Confusion
- Fall
- Generalized weakness
- Hallucinations
- Hunger
- Impaired coordination
- Irritability
- Pallor
- Sweating
- Poor concentration
- Seizure
- Stroke
Care Measures Associated with Diabetes

- Risk of hypoglycemia
  - Especially with secretagogues and insulin
- Cognitive decline
  - Partially or completely dependent for intake of food and fluids
    - Weight loss
    - Poor nutrition
    - Dehydration
- Infectious illness
- Polypharmacy
  - Control of chronic co-morbid conditions
- Functional Decline
  - Falls with and without injury
  - Bladder and bowel incontinence
- Mood Disorders
  - Anxiety and Depression
- Chronic pain syndromes
- Pressure and Diabetic wounds
# FCHP - HEDIS Measures 2014

## Diabetes Mellitus

<table>
<thead>
<tr>
<th>Measures</th>
<th>Care, Screening or Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive Diabetes Care</td>
<td>Yearly screening of the following:</td>
</tr>
<tr>
<td><strong>Age 18 - 75</strong></td>
<td><strong>HgA1 testing</strong></td>
</tr>
<tr>
<td></td>
<td>&gt; 9.0 = poor control</td>
</tr>
<tr>
<td></td>
<td>&lt; 8.0 = good control</td>
</tr>
<tr>
<td></td>
<td><strong>LDL-C</strong></td>
</tr>
<tr>
<td></td>
<td>Target &lt;100</td>
</tr>
<tr>
<td></td>
<td><strong>Retinal eye exam</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Nephropathy screening</strong></td>
</tr>
<tr>
<td></td>
<td>Blood pressure collected as 2 measures (&lt; 140/90; &lt; 140/80)</td>
</tr>
</tbody>
</table>
# Diagnostic Criteria

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random Plasma Glucose</td>
<td>200+ mg/dL with symptoms of hyperglycemia</td>
</tr>
<tr>
<td>Fasting Plasma Glucose</td>
<td>126+ mg/dL on 2 occasions</td>
</tr>
<tr>
<td>Oral Glucose Tolerance Test</td>
<td>2-hour plasma glucose 200+ mg/dL after a 75-g glucose load</td>
</tr>
<tr>
<td><strong>HgA1c</strong></td>
<td><strong>6.5+ is diagnostic</strong></td>
</tr>
</tbody>
</table>

Differential Diagnosis: Type 1 Diabetes Mellitus, Prediabetes, Cushing’s Syndrome, Glucagonoma, Acromegaly.
Criteria for HgA1c Based Diagnosis

• The ADA published guidelines in January 2010 and again in January 2011 that recommend HgA1c level as an option for making the diagnosis of diabetes.

• The ADA did not recommend HgA1c for diagnosis prior to 2010 because of lack of standardization of the assay used to do the test.
  • Only standardized, validated assays should be used for HgA1c measurement (The lab should be certified by the NGSP).

Threshold 6.5%
Criteria for HgA1c Based Diagnosis

- Traditional glucose criteria should be used for diagnosis when feasible (AACE).
- If blood glucose levels are normal and the HgA1c exceeds 6.5%, the HgA1c should be repeated.
- HgA1c is not recommended for the diagnosis of type I diabetes or the diagnosis of gestational diabetes.
- HgA1c may be misleading in conditions associated with hemolysis, anemia, and severe hepatic or renal disease.
# Therapeutic Glycemic Targets

<table>
<thead>
<tr>
<th></th>
<th>IDF</th>
<th>ADA</th>
<th>AACE</th>
<th>AGS</th>
<th>AMDA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HgA1c (%)</strong></td>
<td>&lt; 6.5%</td>
<td>&lt; 7.0%</td>
<td>&lt;= 6.5%</td>
<td>*&lt;7%</td>
<td>*&lt;7%</td>
</tr>
<tr>
<td><strong>PrePG (mg/dL)</strong></td>
<td>&lt; 110 mg/dL</td>
<td>70 – 130 mg/dL</td>
<td>70 – 130 mg/dL</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>PPG (mg/dL)</strong></td>
<td>&lt; 145 mg/dL</td>
<td>&lt; 180 mg/dL</td>
<td>&lt; 180 mg/dL</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

IDF = International Diabetes Federation  
ADA = American Diabetes Association  
AACE = American Association of Clinical Endocrinologist  
AGS = American Geriatrics Society  
AMDA = American Medical Director’s Association
FPG & PPG Contribution to A1c

For poorly controlled diabetics, FPG has a greater contribution to HgA1c.

FPG and PPG have equal contribution on A1c at level of 8.0%.

PPG has a 70% contribution at A1c of 7.3%.
PPG: Current Treatment Guidelines

• ADA Guidelines
  • Include A1C measurements if a patient achieves FPG levels but does not meet A1c goals.

• AACE Guidelines
  • Management of the diabetic must include strategies that address both FPG and PPG.

• IDF
  • To achieve A1C goals, controlling PPG excursions is at least as important, and perhaps more important, than lowering FPG levels.
  • Optimal glycemic control cannot be achieved without adequate management of post-meal glucose.
AMDA Diabetes Treatment Guideline

• Step 1
  – Lifestyle changes with metformin; or
  – Lifestyle changes with additional oral agents; or
  – Lifestyle changes combined with insulin therapy

• Step 2
  – Increase intensity of therapy using a tailored approach until desired levels of glycemic control are achieved.
AACE 2013 Guidelines

• A1c targets
  – 6.5 or under for healthy patients who have no concurrent illness and are not at risk for hypoglycemia.
  – > 6.5 with goals individualized for patients who have concurrent illness and are at risk for hypoglycemia.

• Therapy should be initiated with lifestyle modification and these modifications should be maintained throughout the course of therapy.
Appropriate Glycemic Targets

Reid T.; J of Managed Care Med; Vol 17. No. 1; 2014
## Oral Agents

### Insulin Sensitizers

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Primary MOA</th>
<th>A1c Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biguanides</strong></td>
<td>Metformin</td>
<td>Reduce amount of glucose released from the liver. Increases sensitivity to insulin, increasing cellular uptake of glucose.</td>
<td>1.0% – 2.0%</td>
</tr>
<tr>
<td><strong>TZD’s</strong></td>
<td>Pioglitazone</td>
<td>Activate PPAR’s thus reducing insulin resistance.</td>
<td>0.5% - 1.4%</td>
</tr>
<tr>
<td></td>
<td>Rivoglitazone</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rosiglitazone</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Troglitazone</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dual PPAR Agonists</strong></td>
<td>Saroglitazar</td>
<td>Activate PPAR’s thus reducing insulin resistance.</td>
<td></td>
</tr>
</tbody>
</table>

PPAR = peroxisome proliferator-activated receptor
## Oral Agents
### Insulin Secretagogues

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Primary MOA</th>
<th>A1c Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfonylureas</td>
<td>Glipizide, Glimeperide</td>
<td>Increased secretion of insulin from pancreatic beta cells</td>
<td>~ 1.5%</td>
</tr>
<tr>
<td>Meglitinides/Glinides</td>
<td>Nateglinide, Repaglinide, Mitiglininide</td>
<td>Increased secretion of insulin from pancreatic beta cells</td>
<td>1.0% - 1.5%</td>
</tr>
<tr>
<td>GLP-1 Agonists</td>
<td>Exenatide, Liraglutide, Taspoglutide</td>
<td>Incretin mimetic</td>
<td></td>
</tr>
<tr>
<td>DPP-4 inhibitors</td>
<td>Alogliptin, Anagliptin, Gemigliptin, Linagliptin</td>
<td>Increase incretin levels (GLP-1 and GIP), Reduce glucagon rate of release, increase insulin secretion, decrease gastric emptying</td>
<td>0.5% - 1.0%</td>
</tr>
</tbody>
</table>
# Oral Agents

## Other Agents

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Primary MOA</th>
<th>A1c Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha-glucosidase inhibitors</td>
<td>Acarbose, Miglitol, Voglibose</td>
<td>Inhibits digestion of carbohydrates</td>
<td>0.5% - 0.8%</td>
</tr>
<tr>
<td>Amylin analogues</td>
<td>Pramlintide</td>
<td>Slows gastric emptying and promotes satiety</td>
<td></td>
</tr>
<tr>
<td>SGL2 inhibitors</td>
<td>Canagliflozin</td>
<td>Inhibits SGL2 sodium-glucose transporters to reduce renal reabsorption of glucose</td>
<td></td>
</tr>
<tr>
<td>Bile Acid Sequestrant</td>
<td>Colesevelam</td>
<td>Binds intestinal bile acids</td>
<td>Indirect</td>
</tr>
<tr>
<td>Dopamine Agonist</td>
<td>Bromocriptine</td>
<td>Stimulates dopamine receptors and inhibits anterior pituitary prolactin secretion</td>
<td>Indirect</td>
</tr>
</tbody>
</table>
Monotherapy

• Choice of agents listed in suggested hierarchy of usage.
  – Metformin
  – GLP-1 receptor agonist
  – DPP-4 inhibitor
  – Alpha-glucosidase inhibitor
  – SGLT2 inhibitor – use with caution
  – TZD – use with caution
  – Sulfonylurea/glinide – use with caution

If A1C > 6.5% in 3 months, add second drug (dual therapy)
# Medication Profiles

<table>
<thead>
<tr>
<th></th>
<th>MET</th>
<th>GLP-1 RA</th>
<th>DPP4 i</th>
<th>AGI</th>
<th>SGLT2 i</th>
<th>TZD</th>
<th>SU/GLN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HYPO</strong></td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Mod- Sev/Mild</td>
</tr>
<tr>
<td><strong>WEIGHT</strong></td>
<td>Slight Loss</td>
<td>Loss</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Loss</td>
<td>Gain</td>
<td>Gain</td>
</tr>
<tr>
<td><strong>RENAL/G U</strong></td>
<td>Contra-indicated stage 3b,4, 5</td>
<td>Exenatide contra-indicated CrCl &lt; 30</td>
<td>Dose adjustment may be necessary except Linagliptin</td>
<td>Neutral</td>
<td>Infections</td>
<td>May worsen fluid retention</td>
<td>More hypo risk</td>
</tr>
<tr>
<td><strong>GI Sx</strong></td>
<td>Moderate</td>
<td>Moderate</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Moderate</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td><strong>CHF</strong></td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>CVD</strong></td>
<td>Benefit</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>?</td>
</tr>
<tr>
<td><strong>Bone</strong></td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>? Bone Loss</td>
<td>Moderate bone loss</td>
<td>Neutral</td>
</tr>
</tbody>
</table>
Exposure to Hyperglycemia

Poor Clinical Inertia results in failure to reach control goals in a defined time. By the time insulin is initiated, the average patient has had an **A1c > 7% for 10 years** and **> 8% for 5 years**.

Reid T.; J of Managed Care Med; Vol 17. No. 1; 2014
Dual Therapy

• Choice of agents to be added to Metformin or other 1\textsuperscript{st} line agent listed in suggested hierarchy of usage.
  – GLP-1 receptor agonist
  – DPP-4 inhibitor
  – TZD – use with caution
  – SGLT2 inhibitor – use with caution
  – \textbf{Basal Insulin – use with caution}
  – Colesevelam
  – Bromocriptine QR
  – Alpha-glucosidase inhibitor
  – Sulfonylurea/glinide – use with caution

If not at A1c goal in 3 months add third drug (triple therapy)
Triple Therapy

• Choice of agents to be added to Metformin or other 1\textsuperscript{st} line agent plus 2\textsuperscript{nd} line agent listed in suggested hierarchy of usage.
  – GLP-1 receptor agonist
  – TZD – use with caution
  – SGLT2 inhibitor – use with caution
  – \textit{Basal Insulin} – use with caution
  – DPP-4 inhibitor
  – Colesevelam
  – Bromocriptine QR
  – Alpha-glucosidase inhibitor
  – Sulfonylurea/glinide – use with caution

If not at A1c goal in 3 months, start \textbf{basal (long-acting) insulin}

Intensify insulin (add \textbf{short-acting insulin} for prandial control)
## Insulin Profiles

<table>
<thead>
<tr>
<th>Insulin</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-Acting Basal Insulin (Lantus)</td>
<td>1 – 2 H</td>
<td>None</td>
<td>24H</td>
</tr>
<tr>
<td>Long-Acting Basal Insulin (Levemir)</td>
<td>3 -4 H</td>
<td>6 – 8 H</td>
<td>6 – 24 H</td>
</tr>
<tr>
<td>NPH Insulin</td>
<td>1 – 1.5 H</td>
<td>4 – 12 H</td>
<td>24 H</td>
</tr>
<tr>
<td>Premix Insulin</td>
<td>30 min</td>
<td>2 – 12 H</td>
<td>24 H</td>
</tr>
<tr>
<td>Regular human insulin (Humulin. Novolin)</td>
<td>0.5 – 1 H</td>
<td>2 – 3 H</td>
<td>5 – 8 H</td>
</tr>
<tr>
<td>Rapid acting insulin (Apidra, Humalog, Novolog)</td>
<td>20 min</td>
<td>.5 – 1.5 H</td>
<td>3 – 4 H</td>
</tr>
<tr>
<td></td>
<td>15 min</td>
<td>.5 – 1.5 H</td>
<td>3 – 4 H</td>
</tr>
<tr>
<td></td>
<td>30 min</td>
<td>1 – 3 H</td>
<td>3 – 5 H</td>
</tr>
</tbody>
</table>
Barriers to Insulin Therapy

• Physician Barriers
  – Clinical inertia
    • Need to reassess and adjustment every 3 months
  – Fear of hypoglycemia
  – Weight gain
  – Perception of time and personal requirements to achieve clinical improvement
  – Multiple therapeutic options other than insulin
    • Hold off on insulin until the last minute
Barriers to Insulin Therapy

- Patient Barriers
  - Insulin horror stories from the family
  - Hypoglycemia
  - Don’t want to deal with needles
  - Financial/Insurance coverage
    - Restrictions for pen devices and monitoring supplies
  - Patient and family education
    - Glucagon administration for hypoglycemia
Insulin Regimens

Reid T.; J of Managed Care Med; Vol 17. No. 1; 2014
### Parameters for Insulin Titration

<table>
<thead>
<tr>
<th>For A1C &lt; 8% total daily insulin dose: 0.1 – 0.2 U/kg</th>
<th>For A1C &gt; 8% total daily insulin dose: 0.2 – 0.3 U/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titrate insulin every 2-3 days to reach Target A1C &lt; 7% and fasting plasma glucose levels &lt; 110 mg/dL in the absence of hypoglycemia.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Fixed regimen</strong></th>
<th><strong>Adjustable regimen</strong></th>
<th><strong>If hypoglycemia</strong></th>
</tr>
</thead>
</table>
| Increase total daily dose by 2 units. | **FBS > 180 mg/dL:** add 4 U  
**FBS 140 – 180 mg/dL:** add 2U  
**FBS 110 – 139 mg/dL:** add 1U | Reduce total daily dose by 10% - 20% for BG < 70 mg/dL  
20% - 40% for BG < 40 mg/dL |

Consider discontinuing or reducing sulfonylurea after initiation of basal insulin.

If A1C does not reach therapeutic goal, intensify insulin therapy by adding short acting insulin for greater prandial control.
### Adding Prandial Insulin

#### Stepwise Titration of Prandial Insulin

| Total daily dose: 0.3 – 0.5 U/kg | 50% basal analog; 50% prandial analog | NPH and regular or premixed insulin can be used but is less desirable |

Titrate insulin every 2 – 3 days to reach glycemic goal: A1C <7%, fasting, premeal glucose < 110 mg/dL in absence of hypoglycemia for most patients with type 2 diabetes.

**Basal**

**Fixed Regimen**

Increase total daily dose by 2U

**Adjustable regimen**

- FBS > 180 mg/dL: add 4U
- FBS 140 – 180 mg/dL: add 2U
- FBS 100 – 139 mg/dL: add 1U

**Prandial**

Increase dose by 10% for any meal if 2 hour postprandial or next premeal glucose > 180 mg/dL

**PreMixed**

Increase total daily dose by 10% if fasting premeal glucose > 180 mg/dL

**If hypoglycemia**

- **Fasting AM:** reduce basal insulin

**Nighttime:**

Reduce basal and/or pre-dinner or pre-evening snack short/rapid acting insulin

**Between meal daytime:** reduce previous premeal short/rapid-acting insulin
Broad Care Plan Goals

• Educate the resident and family about diabetes, its potential affect on lifestyle, and treatment options.
• Develop a customized plan of care that maximizes potential for successful outcome.
• Maintain maximum nutritional status.
• Control pain and neuropathic symptoms.
• Clarify advance directives and the medical decision making process.
Broad Care Plan Goals

• Set targets of therapy
  – HgA1c
  – Fasting and Post Prandial glucose levels
  – Blood pressure
  – Lipid levels

• Optimize physical activity and functional status.

• Protect against lower extremity wounds, infections, and limb loss.
Sliding Scale Insulin

• Definition
  – Sliding scale can be defined as a set of instructions for adjusting the dose of insulin in accordance with the results of blood sugar levels. It is typically used in hospitalized patients to control their blood glucose.
Questions Regarding SSI

• When should it be used?
  – May be used in the hospital setting to control hyperglycemia.

• Are there any disadvantages?
  – Superficially it seems to make sense. However, many studies have shown that SSI results in poor control of blood glucose in hospitalized patients, which in turn results in poor prognosis.

• What’s the alternative? How do I get there?
• American Diabetes Association
  – Traditional SSI is not recommended as monotherapy

• American Medical Directors Association
  – Prolonged use of SSI is not recommended
  – Residents on SSI regimen should be assessed after one week and changed to fixed doses of insulin, if possible
  – Widespread use of SSI may result in increased nursing time due to more frequent blood glucose monitoring and insulin injections

• Medicare State Operations Manual (F329)
  – Long-term use of sliding scale insulin for non-emergency coverage may indicate inadequate blood sugar control
<table>
<thead>
<tr>
<th>Therapy</th>
<th>Monitoring Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-pharmacologic or oral agent</td>
<td>Twice daily at least 2 to 3 days per week. Times should be rotated and checking postprandial results may be useful.</td>
</tr>
<tr>
<td>Simple insulin regimen (1 or 2 scheduled doses of insulin injections per day)</td>
<td>Twice daily at least 3 to 4 days per week. Times should be rotated and checking postprandial results may be useful.</td>
</tr>
<tr>
<td>Complex insulin regimen (3 or more scheduled injections of insulin per day)</td>
<td>Four or more times every day; checking post-prandial levels may be helpful.</td>
</tr>
</tbody>
</table>
Case Study

• 82-year-old female
• Diabetes Mellitus Type II X 15 years
• Hemoglobin A1c = 8.8%; Creatinine 1.9
• Sliding Scale Coverage QID
• Basal Insulin: 10 units daily
Converting Sliding Scale

- **Importance:**
  - RISS now on BEERS List of potentially inappropriate medications in the elderly
  - Improve quality of life by decreasing the frequency of fingersticks
  - Improve quality of diabetes management by:
    - Decreasing hyperglycemic episodes
    - Increasing number of times fingersticks are ‘In The Zone’
    - Discontinuation of RISS
    - Improve Hg-A1c
    - Decrease risk of hypoglycemia

RISS = Regular Insulin Sliding Scale
# Week #1

<table>
<thead>
<tr>
<th></th>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-breakfast Glucose</strong></td>
<td>234</td>
<td>252</td>
<td>268</td>
<td>278</td>
<td>284</td>
<td>362</td>
<td>270</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td><strong>Pre-lunch Glucose</strong></td>
<td>188</td>
<td>124</td>
<td>178</td>
<td>170</td>
<td>195</td>
<td>200</td>
<td>183</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>6</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td><strong>Pre-dinner Glucose</strong></td>
<td>199</td>
<td>207</td>
<td>220</td>
<td>227</td>
<td>201</td>
<td>270</td>
<td>188</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td><strong>9 PM Glucose</strong></td>
<td>190</td>
<td>179</td>
<td>178</td>
<td>179</td>
<td>74</td>
<td>184</td>
<td>190</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

141 – 180 4 units  
181 – 220 6 units  
221 – 260 8 units  
261 – 300 10 units 
301 – 350 12 units 
351 – 400 14 units  
> 400 16 units
Converting Sliding Scale

- Summary of gradual conversion:
  
  o **Week 1:**
    - Assess current degree of blood glucose control, use of insulin, and burden of treatments
    - Start long-acting insulin

  o **Weeks 2-5:**
    - Titrate long-acting insulin over 3-5 week period
    - Decrease use of RISS

  o **Week 5-6:**
    - Re-check degree of control, use of insulin, and burden of treatments
    - Add standing pre-prandial insulin if necessary; decrease fingersticks
    - Discontinue RISS

RISS = Regular Insulin Sliding Scale
### Week #2

<table>
<thead>
<tr>
<th></th>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-breakfast Glucose</strong></td>
<td>211</td>
<td>227</td>
<td>242</td>
<td>253</td>
<td>256</td>
<td>234</td>
<td>330</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td><strong>Pre-lunch Glucose</strong></td>
<td>170</td>
<td>112</td>
<td>140</td>
<td>153</td>
<td>176</td>
<td>180</td>
<td>165</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><strong>Pre-dinner Glucose</strong></td>
<td>189</td>
<td>157</td>
<td>220</td>
<td>227</td>
<td>201</td>
<td>270</td>
<td>188</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td><strong>9 PM Glucose</strong></td>
<td>171</td>
<td>161</td>
<td>159</td>
<td>155</td>
<td>114</td>
<td>70</td>
<td>169</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

**Coverage Levels**
- 141 – 180: 4 units
- 181 – 220: 6 units
- 221 – 260: 8 units
- 261 – 300: 10 units
- 301 – 350: 12 units
- 351 – 400: 14 units
- > 400: 16 units
Converting Sliding Scale

SNF Physician WORKSHEET for Gradual Conversion to Long-Acting Insulin and Removal of Regular Insulin Sliding Scale (RISS):

**WEEK 1: Goal:** Switch intermediate insulin to long-acting insulin.

SNF RN to provide MD with the following data:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Number of fingersticks the patient has had over the past 2 weeks:</td>
<td>56</td>
</tr>
<tr>
<td>2.</td>
<td>Number of times blood sugar was &gt;180 (out of ‘The Zone’) in the past 2 weeks:</td>
<td>34</td>
</tr>
<tr>
<td>3.</td>
<td>Average fasting blood sugar (FBS) level each morning over the past 2 weeks:</td>
<td>264.4</td>
</tr>
<tr>
<td>4.</td>
<td>Total number of units of intermediate-acting insulin (ie, NPH) given each day</td>
<td>10</td>
</tr>
<tr>
<td>5.</td>
<td>Average units of regular insulin (RISS) given each day for past 2 weeks:</td>
<td>23.3</td>
</tr>
<tr>
<td>6.</td>
<td>Date and value of last Hemoglobin A1c</td>
<td>3/31/14</td>
</tr>
</tbody>
</table>
Converting Sliding Scale

Sample orders for week 1:

a. Start long-acting insulin (Lantus or Levemir) SQ qAM as follows:
   A) If average FBS (#3 above) = 70-139, the single dose of long-acting insulin should be the same as the total intermediate-acting daily dose (#4 above; a 1:1 conversion)
   B) If average FBS 140-180, give #4 above + 4 units
   C) If average FBS >180, give #4 above + 6 units
   D) Discontinue intermediate-acting insulin (ie, NPH, 70/30) now
   E) Continue to monitor blood glucose per routine
b. Recheck A1c now if last result is more than 6 months old
Converting Sliding Scale

Sample Orders

**WEEKS 2-5:** **Goal:** Gradual titration of long-acting insulin targeting the average FBS. Expecting to see more fingersticks within “The Zone” (100-180), and a decreased need for regular insulin before meals. Continue process until dose of long-acting insulin is stable, even if it takes longer than 4 weeks.

*Sample orders for weeks 2-4:*

a. Adjust daily long-acting insulin dose weekly as follows:
   a. If average FBS > 180, increase dose by 2 units
   b. If average FBS 140 – 180, increase dose by 1 unit
   c. If average FBS 90 – 140, no change
   d. If average FBS < 90, decrease dose by 1 unit
Sample Orders

**Week 5/6: Goal:** Switch from regular insulin to a small, standing, bolus-dose of rapid-acting insulin before/during meals if needed. (Many patients will only need this once a day, or not at all.) Decrease frequency of fingersticks. Discontinue RISS.

*Sample orders for weeks 5-6:*

a. Start standing dose of ultra-short acting insulin (Apidra or Lispro) SQ before meals
b. Decrease fingerstick frequency
c. Discontinue RISS
d. Recheck A1c in 2 months
### Converting Sliding Scale

**At Conclusion:**

SNF RN to provide MD with a second set of data:

<table>
<thead>
<tr>
<th>Number</th>
<th>(Today’s Date:  )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Number of fingersticks the patient has had over the past 2 weeks:</td>
<td>16 (56)</td>
</tr>
<tr>
<td>2. Number of times blood sugar was &gt;180 (out of ‘The Zone’) in the past 2 weeks:</td>
<td>16 (34)</td>
</tr>
<tr>
<td>3. Average fasting blood sugar (FBS) level each morning over the past 2 weeks:</td>
<td>160 (264.4)</td>
</tr>
<tr>
<td>4. Total number of units of <strong>LONG-ACTING</strong> insulin given each day</td>
<td>20</td>
</tr>
<tr>
<td>5. Average units of regular insulin (RISS) given each day for past 2 weeks:</td>
<td>10</td>
</tr>
<tr>
<td>6. Date and value of last Hemoglobin A1c</td>
<td>Pending</td>
</tr>
</tbody>
</table>
Thank You