Tailoring and Intensifying Insulin Therapy and overcoming Barriers in achieving Glycemic Control in patients living with Diabetes

Facilitators

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Annual Pharmaceutical Retreat
June 21, 2013
Workshop Activities

- Pretest (15 mins)
- Presentation (45 mins)
- 6 Groups of 10 work on: (55 mins)
  - Demonstration of devices
  - Blood Glucose machines and insulin pens
  - Complete post test
  - Review the case
    - Dosing insulin
    - Assess the patient
    - Create a plan to manage the patient
  - Include patient education and counseling
    - Group presents for 10 mins each (Total 50 mins)
- Wrap up/ Summary (10 mins)
Insulin Therapy

Objectives

- Assess their knowledge of the management of the different types of diabetes
- Identify the different types of insulins that are commonly used
- Identify the barriers associated with insulin therapy and ways to overcome them
- Highlight the latest research and developments in insulin therapy
- Highlight the role of the pharmacist in the management of diabetes
Advantages of Insulin Therapy

- Oldest of the currently available medications, has the most clinical experience
- Most effective of the diabetes medications in lowering glycemia
  - Can decrease any level of elevated HbA₁c
  - No maximum dose of insulin beyond which a therapeutic effect will not occur
- Beneficial effects on triglyceride and HDL cholesterol levels

Insulin

Overview

- A pancreatic hormone produced by the beta islets of Langerhans
- Regulates body glucose
- Increases the uptake of glucose and its conversion to glycogen by liver, muscle, and fat tissue
- Prevents the utilization of fat as an energy source
- In absence or decreased levels of insulin, glucose uptake ceases and fat utilization (lipolysis) for energy increases.
Insulin

- Elevated blood glucose concentrations stimulates insulin production
- Other stimuli that also promote insulin secretion include: -sight & taste of food
  - nerve stimulation
  - increased blood concentrations of other fuel molecules like amino acids and fatty acids
Goal of Insulin Therapy

Trying to duplicate how the Pancreas works in releasing Insulin for someone who doesn’t have diabetes
Regulation of glucose by the Pancreas
Purpose of Insulin Therapy

- Prevent and treat fasting and postprandial hyperglycemia
- Permit appropriate utilization of glucose and other nutrients by peripheral tissues
- Suppress hepatic glucose production
- Prevent acute complications of uncontrolled diabetes
- Prevent long term complications of chronic diabetes
Insulin

What happens when there is insufficient insulin?

- Exogenous Insulin are being administered
- Works very well
- Low cost
- Dosage must be individualize
- Different preparations are available
Types of Insulin
• There are different types of insulin depending on how quickly they work, when they peak, and how long they last.
• Insulin is available in different strengths; the most common is U-100/ml.
• All insulin available, for example in the United States is manufactured in a laboratory, but animal insulin can still be imported for personal use.
# Types of insulin

<table>
<thead>
<tr>
<th>Type</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rapid-Acting (Insulin Analogues)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspart (Novolog/NovoRapid)</td>
<td>&lt;15 mins</td>
<td>1-2 Hrs</td>
<td>3-5 Hrs</td>
</tr>
<tr>
<td>Lispro (Humalog)</td>
<td>&lt;15 mins</td>
<td>0.5-3 Hrs</td>
<td>3-4 Hrs</td>
</tr>
<tr>
<td>Glulisine (Apidra)</td>
<td>10-30 mins</td>
<td>0.5-3 Hrs</td>
<td>3-5 Hrs</td>
</tr>
<tr>
<td><strong>Inhaled Insulin Powder</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exubera</td>
<td>10-20 mins</td>
<td>2 Hrs</td>
<td>Up to 6 Hrs</td>
</tr>
<tr>
<td><strong>Short-Acting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Novolin R</td>
<td>0.5-1 Hr</td>
<td>2-4 Hrs</td>
<td>3-6 Hrs or up to 8 Hrs</td>
</tr>
<tr>
<td>Humulin R</td>
<td>0.5-1 Hr</td>
<td>2-4 Hrs</td>
<td>3-6 Hrs or up to 8 Hrs</td>
</tr>
<tr>
<td><strong>Intermediate-Acting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Novolin N</td>
<td>2-4 Hrs</td>
<td>4-10 Hrs</td>
<td>10-16 Hrs</td>
</tr>
<tr>
<td>Humulin N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Long-Acting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detemir (Levemir)</td>
<td>1-2 Hrs</td>
<td>Peak-less</td>
<td>20-24 Hrs</td>
</tr>
<tr>
<td>Glargine (Lantus)</td>
<td>2-4 Hrs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Types of insulin cont’d

<table>
<thead>
<tr>
<th>Type</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Insulin Mixtures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70% NPH/30% Regular</td>
<td>0.5-2 Hrs</td>
<td>2-10 Hrs</td>
<td>10-16 Hrs</td>
</tr>
<tr>
<td>Novolin 70/30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humulin 70/30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humulin 50/50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analogue Mixtures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70% Aspart Protamine/30%Aspart (NovoMix 30/Novolog Mix 70/30)</td>
<td>&lt;15 mins</td>
<td>1-2 Hrs</td>
<td>10-16 Hrs</td>
</tr>
<tr>
<td>75% Lisproprotamine/30%Lispro (Humalog 75/25)</td>
<td>&lt;15 mins</td>
<td>1-2 Hrs</td>
<td>10-16 Hrs</td>
</tr>
<tr>
<td>50%Lisproprotamine/50%Lispro (Humalog Mix 50/50)</td>
<td>&lt;15 mins</td>
<td>1-2 Hrs</td>
<td>10-12 Hrs</td>
</tr>
</tbody>
</table>

### Insulin-like Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byetta</td>
<td>10 mins</td>
<td>2 hours</td>
<td>10 hours</td>
</tr>
<tr>
<td>Symlin</td>
<td>Information not available</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Difference(s) between Human Insulin and Analogue Insulin

- Human Insulin is a replica of Insulin found naturally in human beings synthetically prepared (R DNA tech).
- Made up of a number of molecules “self-aggregate” to form Diemers, which is stabilise by zinc ions to form Hexamers.

- Analogue Insulin - is an altered form of this human insulin by addition, substitution or subtraction of one or more amino acid chain(s).

- Reason - to make the insulin more safe and effective for Human use.
Limitations of Regular Human Insulin

- Slow onset of activity
  - Should be given 30 to 45 minutes before meal
- Inconvenient for patients
- Long duration of activity
  - Lasts up to 12 hours
- Potential for late postprandial hypoglycaemia (4-6 hours)
  - Need for additional snack
Dissociation of Regular Human Insulin

peak time 2-4 hr

formulation ↔ hexamers ↔ dimers ↔ monomers

capillary membrane
Insulin Analogues

**Human Insulin**
Dimers and hexamers in solution

**Aspart**
Limited self-aggregation
Monomers in solution

**Glulisine**
Limited self-aggregation
Monomers in solution

**Lispro**
Limited self-aggregation
Monomers in solution

**Glargine**
Soluble at low pH
Precipitates at neutral (subcutaneous) pH
Idealized action profiles of insulin analogues
# Metabolic targets since 2001

<table>
<thead>
<tr>
<th>Metabolic parameter</th>
<th>Target value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fasting plasma glucose</strong></td>
<td>4.5-6.0</td>
</tr>
<tr>
<td><strong>2-hr postprandial glucose</strong></td>
<td>4.5-7.8</td>
</tr>
<tr>
<td><strong>HbA$_1c$</strong></td>
<td>&lt;7%</td>
</tr>
<tr>
<td><strong>LDL-C</strong></td>
<td>&lt;2.6 mmol/l</td>
</tr>
<tr>
<td><strong>HDL-C</strong></td>
<td>&gt;1.1 mmol/l</td>
</tr>
<tr>
<td><strong>Triglycerides</strong></td>
<td>&lt;1.7 mmol/l</td>
</tr>
<tr>
<td><strong>Blood pressure</strong></td>
<td>&lt;130/80</td>
</tr>
</tbody>
</table>

Non-diabetic Insulin and Glucose Profiles

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Insulin (µU/mL)</th>
<th>Glucose (mmo/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supper</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Basal insulin: 0-30 µU/mL
Basal glucose: 3.5-5.5 mmo/L

www.diabetesclinic.ca
Normal Blood Glucose Levels

Blood Glucose (mmols):

- 10
- 8
- 6
- 4
- 2
- 0

Time:

- 8am
- Noon
- 6pm
- 2am
- 4am
- 8am
Normal Blood Glucose Levels

Blood Glucose (mmols)

<table>
<thead>
<tr>
<th>Time</th>
<th>8am</th>
<th>noon</th>
<th>6pm</th>
<th>2am</th>
<th>4am</th>
<th>8am</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

www.diabetesclinic.ca
The Basal/Bolus Insulin Concept

- **Basal insulin**
  - Suppresses glucose production between meals and overnight
  - Nearly constant levels
  - 50% of daily needs

- **Bolus insulin (mealtime or prandial)**
  - Limits hyperglycemia after meals
  - Immediate rise and sharp peak at 1 hour
  - 10% to 20% of total daily insulin requirement at each meal
Blood Glucose (mmols)

Two injections/day

R or H + N in AM

R or H + N at Supper

Time

8am noon 6pm 2am 4am 8am

www.diabetesclinic.ca
### Three injections/day

**Blood Glucose (mmols)**

<table>
<thead>
<tr>
<th>Time</th>
<th>8am</th>
<th>noon</th>
<th>6pm</th>
<th>2am</th>
<th>4am</th>
<th>8am</th>
</tr>
</thead>
<tbody>
<tr>
<td>R or H + N in AM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R or H at Supper</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N before bed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Graph showing blood glucose levels throughout the day](https://www.diabetesclinic.ca)
Blood Glucose (mmols)

Four injections/day

- R or H at every meal
- N or U once or twice/day

<table>
<thead>
<tr>
<th>Time</th>
<th>8am</th>
<th>noon</th>
<th>6pm</th>
<th>2am</th>
<th>4am</th>
<th>8am</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
**A1c Goals**

**Individualize goal based on patient risk factors**

- **A1c < 6–7%**
  - Less intensive management if:
    - Evidence of advanced or poorly controlled cardiovascular and/or microvascular complications
    - Hypoglycemia unawareness
    - Vulnerable patient (i.e., impaired cognition, dementia, fall history)

- **A1c < 7–8%**
  - Intensify management if:
    - Absent/stable cardiovascular disease
    - Mild-moderate microvascular complications
    - Intact hypoglycemia awareness
    - Infrequent hypoglycemic episodes
    - Recently diagnosed diabetes

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Proposed Algorithm of therapy for Type 2 Diabetes

Inadequate Non pharmacological therapy

• Severe symptoms
• Severe hyperglycaemia
• Ketosis
• Pregnancy

1 oral agent

2 oral agents

3 oral agents

Add Insulin Earlier in the Algorithm
The ADA and EASD algorithm for the management of type 2 diabetes

Step 1: At Diagnosis: Lifestyle + Metformin

Step 2: Tier 1: Well-validated core therapies
- Lifestyle + Metformin + Basal Insulin
- Lifestyle + Metformin + Sulfonylurea

Tier 2: Less well-validated therapies
- Lifestyle + Metformin + Pioglitazone
  - No Hypoglycemia
  - Edema/CHF
  - Bone Loss
- Lifestyle + Metformin + GLP-1 agonist
  - No Hypoglycemia
  - Weight Loss
  - Nausea/Vomiting

Step 3: Intensive Insulin
- Lifestyle + Metformin + Intensive Insulin

CHF, congestive heart failure; GLP, glucagon-like peptide.
Glycosylated hemoglobin (A1C) should be checked every 3 months until the A1C is <7% and at least every 6 months thereafter.

Sulfonylureas other than glybenclamide (glyburide) or chlorpropamide. Insufficient clinical use to be confident regarding safety.

Step One: Initiating Insulin

- Start with either...
  - Bedtime intermediate-acting insulin or
  - Bedtime or morning long-acting insulin

Insulin regimens should be designed taking lifestyle and meal schedules into account

Step One: Initiating Insulin, cont’d

- Check fasting glucose and increase dose until in target range
  - Target range: 3.89-7.22 mmol/l (70-130 mg/dl)
  - Typical dose increase is 2 units every 3 days, but if fasting glucose >10 mmol/l (>180 mg/dl), can increase by large increments (e.g., 4 units every 3 days)

Calculating Insulin Dosage

Starting at

- 0.2 units/kg to max 1 unit/kg = total daily dose

For Basal Insulin (one dose regimen)
50% of the total daily dose is given once daily as a single dose

2 Injections/day am & pm

Eg: 70/30 or N & R

Total daily dose is done then 2/3 am & 1/3 pm
Three Injections/day

- Dose is calculated as before but in the evenings instead on using both at the same time, R is given at meal time and N at bedtime (works as basal).

Four Injections
1 basal &
3 mealtime doses are given
Where to Inject
Storage & Handling

- Vials must be kept in a cool place or refrigerator.
- Measure desired dose and leave to stand at room temperature for at least five minutes before use.
- Y? cold insulin
tend to sting
Pen/ Cartridge

- 30 days at ROOM temperature after first use
- Extra Cartridge Must be kept in a cool place (refrigerator) until needed
Disposal

- Advice patients to dispose needles and lancets in a “sharps” container away from children
Insulin Therapy

Objectives

- Assess their knowledge of the management of the different types of diabetes
- Identify the different types of insulins that are commonly used
- Identify the barriers associated with insulin therapy and ways to overcome them
- Highlight the latest research and developments in insulin therapy
- Highlight the role of the pharmacist in the management of diabetes
Meet our Patient - Will

Will is in the Rx to drop off a new Prescription. You know he is upset. He presents to you with a Rxtion for detemir 10 units at bedtime via an insulin pen. You start discussing the new Rxtion and you realize he is visibly upset.

You ask and he responds “I never thought my diabetes would get so bad that I would need insulin. I feel like a failure.” He tells you that he remembers his mother being on insulin and how it was awful. She had to carry around all the syringes and insulin everywhere and she absolutely hated it.
Insulin may help to minimize complications related to diabetes if we start the glycemic control early.

Insulin is the most effective "tool" in the blood sugar control "toolbox."

Insulin- No longer the “treatment of last resort”

Education is Key!!

Empower the patient

Effective “tool”

Achieve Target Glycemic Levels

Empower the patient
Natural History of Type 2 Diabetes

- Normal Glucose Tolerance (NGT)
- Impaired Glucose Tolerance (IGT)
- Frank Diabetes

Risk of Microvascular Complications
Risk of Macrovascular Complications

- Insulin Resistance
- Insulin Secretion
- Postprandial Glucose
- Fasting Blood Glucose

Severity of Glucose Intolerance

Years to Decades

Worsens with Time
Insulin Sensitivity in Glucose Clamp Studies: Improved by Insulin Treatment

DAWN the psychosocial barriers effecting diabetes management.

- Novo Nordisk initiated the DAWN™ (Diabetes Attitudes Wishes and Needs) study in 2001, in conjunction with the International Diabetes Federation (IDF) and an expert advisory panel
- over 5,000 people with diabetes
- 3,800 health care professionals
- 13 countries
### Table - Patient Attitudes Towards Insulin Therapy, Unwilling versus Willing Subjects

<table>
<thead>
<tr>
<th></th>
<th>Unwilling to take insulin (%)</th>
<th>Willing to take insulin (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worsening disease</td>
<td>46.7</td>
<td>35.4</td>
</tr>
<tr>
<td>Restrictions of usual activities</td>
<td>56.1</td>
<td>41.6</td>
</tr>
<tr>
<td>Needle pain</td>
<td>50.8</td>
<td>30.2</td>
</tr>
<tr>
<td>Problematic hypoglycemia</td>
<td>49.3</td>
<td>37.9</td>
</tr>
<tr>
<td>Unable to handle demands of insulin therapy</td>
<td>58.1</td>
<td>39.7</td>
</tr>
<tr>
<td>Personal failure</td>
<td>55.0</td>
<td>33.6</td>
</tr>
</tbody>
</table>

Patients willingness to start insulin therapy

Study by Polonsky et al in 2011 – *Are patients with type 2 diabetes reluctant to start insulin therapy? An examination of the scope and underpinnings of psychological insulin resistance in a large, international population*

*Data from a survey of 1400 insulin-naïve patients with Type 2 DM*
Factors influencing medication initiation, adherence and persistence

- Symptom severity
- Benefits
- Side-effects
- Regimen complexity
- Costs
- Medication beliefs
- Regimen Comprehension
- Communication
- Treatment beliefs

Adherence to pharmacologic therapy in patients with T2DM.
WHAT!? Did you say INSULIN?!

Barriers to the Use of Insulin
Meet our Patient - Will

Will is in the Rx to drop off a new Prescription. You know he is upset. He presents to you with a Rxtion for detemir 10units at bedtime via an insulin pen. You start discussing the new Rxtion and you realize he is visibly upset.

You ask and he responds “I never thought my diabetes would get so bad that I would need insulin. I feel like a failure” He tells you that he remembers his mother being on insulin and how it was awful. She had to carry around all the syringes and insulin everywhere and she absolutely hated it.
Patient Concerns About Insulin

- Fear of injections
- Perceived significance of need for insulin
- Worries that insulin could worsen diabetes
- Fear of hypoglycemia – “Insulin Shock”
- Complexity of regimens
Patient Concerns About Insulin

- Perception that the disease is getting worse
- Weight gain
- Too Expensive
- Stigma - social embarrassment
- Sense of personal failure
Table - Prevalence of barriers to the initiation of insulin therapy perceived by patients and physicians

<table>
<thead>
<tr>
<th>Perceived barrier</th>
<th>Prevalence, %</th>
<th>Prevalence, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patients, insulin naive; users</td>
<td>Physicians</td>
</tr>
<tr>
<td>Fear of hypoglycemia</td>
<td>12; 4</td>
<td>80</td>
</tr>
<tr>
<td>Pain associated with blood testing</td>
<td>5; 7</td>
<td>54</td>
</tr>
<tr>
<td>Weight gain</td>
<td>12; 6</td>
<td>26</td>
</tr>
<tr>
<td>Injection-related pain</td>
<td>12; 17</td>
<td>48</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes not thought to be serious:</td>
<td>47; 7</td>
<td>Perceived patient noncompliance: 92</td>
</tr>
<tr>
<td>Fear of addiction to insulin:</td>
<td>39; 21</td>
<td>Patient too old: 47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diabetes thought to be too advanced for insulin to be beneficial: 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limited experience: 27</td>
</tr>
</tbody>
</table>

Lau et al. Initiating insulin in patients with type 2 diabetes
CMAJ April 17, 2012 vol. 184 no. 7
Provider-Related Barriers to starting Insulin

Initiating Insulin

- Unclear how to initiate insulin
- Afraid of the adverse effects e.g. hypoglycemia
- Limited resources and time
- After all other options—diet, exercise, and oral antidiabetic agents (OADs) alone or in multiple combinations
Provider-Related Barriers to starting Insulin

- **Clinical Inertia**: waiting too long to advance therapy when an individual's clinical indicators suggest change is needed.
- **Avoiding Conflict**: Confrontations, disagreements with patients.
- **Threat**: Using Insulin as a threat.
- **CV Risks**: Insulin therapy may increase the risk of CV disease e.g. atherogenesis.
Role of the Pharmacist in management of Diabetes
Behavioural Change

- Transtheoretical Model
  - Offers guidance for people at all stages who are ready for change
  - Helps us tailor changes in behaviour in order to maximize successful outcomes
  - Pts are at different stages of motivational readiness
  - Better able to make interventions based on the stage that pts are
The Stages of Change

Precontemplation

Preparation

Contemplation

Action

Maintenance
Stages of Change

**Precontemplation**
- not intending to change to a goal of behaviour in the foreseeable future

**Contemplation**
- Intending to change to the goal level in the foreseeable future (next 6 months) but not immediate future (30 days)

**Preparation**
- intending to change to the goal behavioural level in the immediate future and taking behavioural steps in the direction of change
Stages of Change

Action
- Pt has made a change to the goal level of the behaviour in the recent past (6 months)

Maintenance
- has been at the goal level of the behaviour for 6 months and longer

Movement is non-linear through the stages
SLIPS - help to identify challenges or barriers in the process of change
The interesting part of this model is that it recognises you may not always move forward in a straight line. There will be times when you lapse, going back to an earlier stage. Then the time will come when you are ready to advance forwards again. This is expected and part of the process of adopting new behaviours.
Reassurance About Common Concerns

Insulin Therapy in Type 2 DM

- Improves Insulin Sensitivity by Reducing Glucotoxicity
- Reduces Cardiovascular Risk
- Causes Modest Weight Gain
- Rarely Causes Severe Hypoglycemia
- Patients fears and concerns can be addressed by education
Encouraging Patient Adherence

Determine why the patient is nonadherent

- Lack of understanding?
- Lack of motivation?
- Lack of money to pay for the prescription?
- Insulin plan too complex?

Re-education and more frequent follow-up may be needed

Treatment optimization and intensification

Lifestyle + OADs

Basal insulin + OADs

Basal-bolus insulin therapy

Beta cell function (%)

Type 2 diabetes
Patient Education and Counselling to Overcome barriers to insulin Therapy

**Injections**
- Teach Injection Technique
  - Needles are small and fine
  - Newer insulin devices – simply process
  - Silicone coating

**Hypoglycemia**
- SMBG to adjust insulin dose and optimize control.
- Insulin analogs assoc with less hypoglycemia
- Teach signs and symptoms
- Less common with T2DM

**Weight Gain**
- Encourage Physical Exercise
- Training in CHO counting
- Special diets
- Metformin-insulin combination

**Feelings of Failure**
- Explain the progression of T2DM & the eventual need for insulin therapy
Patient Education and Counselling to Overcome barriers to insulin Therapy cont’d

**Insulin is too Expensive**
- Diabetes is expensive!!!
- Insulin is less expensive than using multiple OADs to produce the same glycemic control!!

**Change in Lifestyle**
Older adults or Elderly will affect their independence

- Difficulty in travelling – provide insulin regimens that offer maximum flexibility, strategies for travelling with insulin
- Timing – injecting insulin away from home
Patient Education and Counselling to Overcome barriers to insulin Therapy cont’d

**Sense of loss of control**
- Pt to take control of diabetes by following an insulin regimen

**Lack of Confidence**
- Use of LA insulins which are easily administered either at bedtime or after the evening meal
- Rxists available

**Disease has worsened**
- Explain how most persons will require insulin as the body is not able to make enough
- Insulin offers good glycemic control
What's new in type 1 diabetes treatment?

- Insulin analogues
- Physiological insulin replacement
- Aggressive “intensive” management
  - 4 injections per day
  - Insulin infusion pumps
  - Continuous glucose monitoring systems
  - Integrated technologies for monitoring control
Insulin Therapy - Changed a great deal in 90 years

Number of ways to work with our patients to help them use insulin to achieve better glycemic control

- Insulin needles and Vials
- • More physiologic
  • Insulins
  • Smaller needles
  • New devices
- • Other delivery options e.g. pens, pumps, disposable devices
  • Smart phone monitoring
- • Inhaled Insulin
  • Oral insulin…….
Insulin devices – addressing barriers to insulin therapy

- Address the mechanical barriers assoc with syringes and vial

- Pen devices are increasingly being improved

- Devices are tailored to address specific needs of the different population e.g elderly, visible impaired or manual dexterity disabilities
Insulin injection devices

- Syringes- 100u, 50u, 30u with varying needle gauges and lengths

- Reusable insulin pens eg NovoPen 4, HumaPen Ergo.

- Disposable pen eg HumaPen, Flexpen, Solostar

- Other devices
Insulin Pens

- Convenient, discreet, and easy to teach
- Expensive

Designed to deliver up to 60 units of insulin at a time in single-unit increments
NovoFine® 30 disposable needles designed to help increase injection comfort

Prefilled with 3 mL of NovoLog® Mix 70/30

Large, clear scale for accurate dose setting and adjustment

Easy dose correction—simply dial backward or forward to change dose
E-SMBG

Daily Graph: Sat Sep. 29, 2012

Energy intake: 4213 kcal
Carbohydrates: 596.3 g
Steps: 9352

Blood Glucose Level:
- Prev. BG: 210 mg/dL (29 May 11:48)
- 7 days avg.: 157 mg/dL (L:125, H:210)
- 30 days avg.: 196 mg/dL (L:125, H:312)

Input Features:
- Blood Glucose Level:
  Let's input daily blood glucose levels
- Insulin:
  Let's input daily insulin dose
- Event:
  Input daily activities
- Memo:
  Let's input daily memo
Diabetes Buddy app.

E-SMBG

What’s New - Timesulin®
Advancing Insulin Therapy Through Device Innovation
InDuo® is the newest insulin delivery system that has integrated both the insulin delivery device and the glucose meter.
Insulin Pump

Novo Pen 4
What's new in diabetes treatment?

- Tresiba® (insulin degludec) - The New Generation Basal Insulin or Just another Basal Insulin? a fourth generation insulin duration of action beyond 42 hours
- Tresiba® is the first basal insulin to offer patients the possibility of adjusting the time of injection, when needed
What's’ new in diabetes treatment?

- Once daily GLP analogue Victoza (Liraglutide) for type two diabetes. Obesity indication also. Already in registration process here.

www.diabetesclinic.ca
What's’ new in diabetes treatment?

- Lixisenatide, first once-daily prandial GLP-1 receptor agonist for the treatment of adults with type 2 diabetes mellitus - Sanofi
New Developments

- **Ryzodeg®** which is insulin degludec and insulin aspart for both type one and two diabetes.
- **Ideglira®** which combines degludec and liraglutide for type two.
- **New pens** e.g. FlexTouch®, Novo Nordisk’s latest prefilled insulin pen, which has an easy auto-injector mechanism.
New Developments

- **Onglyza** - dipeptidyl peptidase-4 (DPP4) inhibitor indicated as an adjunct to diet and exercise to improve glycemic control in adults with type 2 diabetes mellitus – Bristol-Myers Squibb/ AstraZeneca
New Developments

- **Insulin tablets** in very early phase of R&D. The new insulin pill - the first ever - has been developed by doctors and scientists in the U.S. and Israel.

- **Injectable Nano-Network Controls Blood Sugar in Diabetics for Days at a Time** network of nanoscale particles that can be injected into the body and release insulin when blood-sugar levels rise, maintaining normal blood sugar levels for more than a week.
New Developments- SmartCells – Merck

- Developed a technology platform that makes it possible to auto-regulate the release of insulin based on the plasma concentration of a designated molecular indicator.

- If successful it has the potential to produce insulin analogs that may result in a lower risk of hypoglycemia (low blood sugar) compared with standard insulin analogs and improve control over both fasting and post meal glucose levels.
Closed-loop artificial pancreas

- Development of a fully automated closed-loop dual sensor bi-hormonal artificial pancreas system that does not require human interaction.
- Custom software application that controls the sensor acquisition and insulin and glucagon delivery based on the glucose values recorded.

Development of a fully automated closed loop artificial pancreas control system with dual pump delivery of insulin and glucagon. Jacobs PG
Let's go over the STEPS
Help Patient Accept and Prepare for Insulin Therapy

• **Address patient concerns**
  – Dispel fear by countering misconceptions
  – Review rationale for insulin use
  – Explain that insulin
    – Can be incorporated into lifestyle
    – Causes only modest weight gain
    – Is a common course of treatment for this progressive disease

• **Promise patient support and close follow-up**
  – Monitoring can prevent hypoglycemia
  – Today’s technology can facilitate daily injections and readings
Help Patient Accept and Prepare for Insulin Therapy

• Provide ongoing self-management support
  • Not only initial education but follow-up
• Address emotional issues
  • What are some concerns/ thoughts they have about insulin
• Adopt successful strategies
  – Monitoring can prevent hypoglycemia
  – Today’s technology can facilitate daily injections and readings
Summary: Insulin Therapy

- Replaces complete lack of insulin in type 1 diabetes
- Supplements progressive deficiency in type 2 diabetes
- Basal insulin added to oral agents can be used to start
- Full replacement requires basal-bolus regimen
- Hypoglycemia and weight gain are main medical risks
- New insulin analogues and injection devices facilitate use
Closing Comments

- Individualization of treatment strategy
- Insulin remains the most important treatment for diabetes – high up on algorithm guidelines
- Insulin is safe and effective when used correctly
- The more comfortable the provider/pharmacist is with insulin, the more the patient will benefit.
- Must incorporate diabetes education
Pharmacists can play a pivotal role in improving adherence to insulin therapy.

Work in collaboration and support the efforts of other members of the health care team in helping patients with T2DM attain and maintain glycemic goals.
References

- http://www.mims.co.uk/news/1174981/Onglyza-approved-triple-oral-therapy/
References

- Thomas Repas. Diabetes, Endocrinology and Nutrition Center, Affinity Medical Group, Neenah, Wisconsin
- Funnell Martha M. Lessons from DAWN: Implementing Effective Insulin Therapy
References