Understanding insulin management: Role of the pharmacist
American Pharmacists Association

Abstract

Objectives: To provide an overview of insulin management and related complications and describe how pharmacists can counsel and assist patients with diabetes.

Summary: A survey conducted by the American Pharmacists Association in the summer of 2013 revealed that pharmacists want and need a better understanding of insulin management. Areas of needed education identified included transitioning a patient to insulin, dosing and titration, and mealtime considerations. Options for treating type 1 and type 2 diabetes are expanding, with new products and strategies for achieving success emerging in the literature. In this article, the authors bring some clarity to these issues and suggest ways that pharmacists can help their patients achieve individualized treatment goals, including educating patients about the different types of insulin; the causes of and management strategies for hypoglycemia; the benefit of good glucose control; how other medications may affect insulin use; and how to manage missed doses and problems with medication adherence.

Conclusion: In the absence of a universal insulin management plan, patients must work closely with their providers in crafting individualized treatment plans, which pharmacists are ideally suited to help advise on and manage for optimal health outcomes.

Keywords: Insulin management, diabetes, glycemic control, adherence.

Overview of insulin management
There are an estimated 25.8 million adults and children in the U.S. with diabetes. About 5% of these, or 1.29 million individuals, have type 1 diabetes.1 These patients require insulin in order to live. Many patients with type 2 diabetes, which is often treated initially with oral medications, ultimately require insulin as well.2 Prior to the 1922 discovery of insulin, patients with type 1 diabetes were put on starvation diets to limit sugar intake and lived for a few months or a few years.3,4 In 1922, the discovery of insulin—which has been called the first life-saving drug in the world—changed their prognosis, extending their lifespan and enabling them to live a nearly normal life.4

Insulin now comes in many formulations with variable pharmacokinetic profiles, enabling today’s diabetes patients to select an insulin and administration schedule based on their personal needs and lifestyles.2

The kind of insulin that is suited to individual patients depends on their level of activity, eating habits, and how their body responds to insulin.5 Today, all patients with diabetes have access to an increasing variety of insulin products to treat the condition. Insulins are commonly classified according to their onset and duration of action as rapid acting, short acting, intermediate acting, and long acting. In addition, mixes of two types of insulin are available.3

Insulin is administered subcutaneously using a syringe or pen device, or a continuous subcutaneous insulin infusion (CSII) device (“insulin pump”).6 Oral insulin and inhaled insulin are in development to offer new options to patients who must take insulin.7 New technology is being used to develop what is sometimes called an “artificial pancreas,” a system of devices that will adjust insulin delivery based on changes in glucose levels as measured by a continuous glucose monitoring (CGM) device.8 Generic insulins, called biosimilars, are also being developed.9

The goal of diabetes treatment is to lower the patient’s risk of diabetes-related complications. Acute complications, such as diabetic ketoacidosis, dehydration, and infections, are often caused by severe hyperglycemia, typically with blood glucose readings greater than 300mg/dL for a sustained period of time. These acute complications can be prevented by keeping blood glucose levels below 200mg/dL or so. The risk of long-term complications associated with diabetes, including retinopathy, nephropathy, and neuropathy, are closely related to the glycosylated hemoglobin, a test of long-term glycemic control commonly called the A1C. Keeping the A1C at normal levels (7% or less) has been shown to prevent long-term complications in patients with type 1 diabetes.2

Guidelines for insulin therapy
A number of professional organizations have published guidelines for managing patients with diabetes. The Standards of Care from the American Diabetes Association (ADA) cover all aspects of patient care: glycemic goals and medication use (including insulin therapy), glucose monitoring, medical nutrition therapy, diabetes self-management education (DSME), lifestyle changes, and comorbid conditions such as hypertension, hyperlipidemia, and others that are common in diabetes patients.2 See ADA’s specific recommendations for insulin management in Table 1.

Type 1 diabetes is typically diagnosed before the age of 30. Individuals with this type must receive insulin. The disorder and its treatment can be challenging to manage in young children and adolescence due to changes in insulin sensitivity related to physical growth and sexual maturity, and limitations to youngsters’ ability to practice self care. An A1C goal of less than 7% is often difficult to achieve but may be appropriate for children and adolescents if it can be achieved without excessive hypoglycemia. The ADA standards recommend that goals should be individualized and may be increased or lowered based on assessment of the benefit–risk ratio.2

Type 2 diabetes usually occurs in adults, although it is increasingly common in obese adolescents. Treatment typically begins with lifestyle changes and oral antidiabetic medications. Due to the progressive nature of type 2 diabetes, insulin therapy is eventually indicated for many patients with type 2 diabetes.2,11

Guidelines from the American Association of Clinical Endocrinologists (AACE) suggest that insulin should be initiated in patients with type 2 diabetes who are symptomatic with an A1C greater than 9%.12 A 2012 joint position statement from ADA and the European Association for the Study of Diabetes stresses the need to develop individualized treatment plans for patients with type 2 diabetes based on each patient’s specific symptoms, comorbidities, age, weight, racial/ethnic/gender differences, and lifestyle-specific considerations.11
The complications of diabetes include:

- Heart disease and stroke – The risk of stroke and cardiovascular death rates among adults with diabetes are about two to four times higher than for adults without diabetes.1
- Hypertension – In 2005–2008, two-thirds of adults aged 20 years or older with self-reported diabetes had blood pressure greater than or equal to 140/90 mm Hg or used prescription medications for hypertension.17
- Hyperlipidemia – Patients with diabetes often have unhealthy cholesterol levels including high LDL cholesterol, low HDL cholesterol, and high triglycerides, which contribute to the development of heart disease.18
- Blindness – Diabetes is the leading cause of new cases of blindness among adults aged 20–74 years.1
- Kidney disease – Diabetes is the leading cause of kidney failure, and many patients develop end-stage renal disease requiring chronic dialysis or a kidney transplant.1
- Neuropathy – About 60% to 70% of people with diabetes have mild to severe forms of nervous system damage. This can lead to foot infections, which may contribute to the need for lower-limb amputations.1

In addition, people with diabetes are more susceptible to many other illnesses and their prognosis is poor. Diabetes patients are more likely to die from pneumonia or influenza than people without diabetes. Depression is more common among patients with diabetes, which can also complicate diabetes management.1

Preventing complications
The good news is that maintaining near-normal glycemia has been shown to significantly reduce many of the complications of diabetes. This was first reported in 1993 in the landmark study the Diabetes Control and Complications Trial (DCCT). The trial compared long-term (10 years) outcomes in type 1 diabetes patients following one of two therapy ap-
Intensive treatment was designed to achieve blood glucose values as close to the normal range as possible utilizing three or more daily insulin injections or continuous subcutaneous insulin infusion treatment with an insulin pump. Participants in the intensive treatment group attempted to get their A1C levels lower than 7% and blood glucose levels of between 70 and 130 mg/dL before meals and less than 180 mg/dL two hours after starting a meal.

The DCCT trial showed that intensive therapy of patients with type 1 diabetes delays the onset and slows the progression of clinically important retinopathy, nephropathy, and neuropathy.

Elements of intensive treatment in DCCT
- Testing blood glucose levels four or more times a day
- Injecting insulin at least three times daily or using an insulin pump
- Adjusting insulin doses according to food intake and exercise
- Following a diet and exercise plan
- Making monthly visits to the health care team

A follow-up study, the Epidemiology of Diabetes Interventions and Complications (EDIC), followed 93% of the original DCCT patients for an additional 12 years to assess the incidence and predictors of cardiovascular events as well as complications related to the eye, kidney, and nerves. The researchers concluded that intensive diabetes therapy has long-term beneficial effects on the risk of cardiovascular disease in patients with type 1 diabetes.

Whether that benefit transfers to patients with type 2 diabetes is a matter of controversy. Although a prospective study in the United Kingdom of type 2 patients did show that intensive treatment reduced the risk of microvascular endpoints, the effects on risk of CVD were modest. Three major trials of intensive glucose control reported no significant reduction in primary cardiovascular endpoints with intensive glucose control in type 2 diabetes patients. In fact, the results of these trials have challenged the conventional belief that lower A1C values should be pursued in all diabetic patients. The Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial showed that not only did intensive therapy fail to prevent macrovascular complications, it was associated with increased mortality. The ACCORD investigators noted that although intensive therapy reduced 5-year nonfatal myocardial infarctions, it increased 5-year mortality. They concluded that such a strategy cannot be recommended for high-risk patients with advanced type 2 diabetes.

The two other studies conducted in type 2 diabetes patients, the Action in Diabetes and Vascular Disease (ADVANCE) trial and the Veterans Affairs Diabetes Trial (VADT), showed that intensive glucose control did lower A1C but had no significant effects on major macrovascular events, death from cardiovascular causes, or death from any cause.

Table 2. Complications of diabetes

<table>
<thead>
<tr>
<th>Type of Complication</th>
<th>Effect</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microvascular</td>
<td>Smallest blood vessels become abnormally thick but weak. They bleed, leak protein, and slow the flow of blood to the cells in the eyes, nerves, and kidneys.</td>
<td>Neuropathy, retinopathy, nephropathy</td>
</tr>
<tr>
<td>Macrovascular</td>
<td>Lipids build up in arteries throughout the body and provoke blood clot formation that obstructs blood flow.</td>
<td>Arteriosclerosis, coronary heart disease, stroke, peripheral vascular disease</td>
</tr>
</tbody>
</table>

[Sources: References 1 and 15]

Although intensive treatment has shown benefits in some patients with diabetes, it is associated with two significant adverse events: hypoglycemia and weight gain. Experts agree that this approach is not for everyone. Children, who require sufficient levels of glucose for brain development, should not attempt intensive treatment until the age of 13 (some recommend it after age 7). Elderly people should also avoid tight control, which is most worthwhile for otherwise healthy people who are expected to live at least 10 more years. Intensive treatment is less likely to help patients who already have major complications such as end-stage renal disease or severe vision loss. Tight glycemic control cannot reverse existing end-organ damage. Patients with coronary artery disease or vascular disease should also avoid intensive therapy.

Intensification of insulin therapy should be tempered by a patient’s willingness and the risk of hypoglycemia. When selecting candidates for intensive control, health care providers should take into account factors such as duration of
diabetes, pre-existing macrovascular disease, hypoglycemic unawareness, and significant comorbidities. A patient with type 2 diabetes who has a fixed daily routine, limited support system, preference for fewer injections, and reluctance to self-monitor blood glucose may be an appropriate candidate for premixed insulins.

Managing insulin therapy
Diabetes is a complex disease that manifests differently in different people. The overarching goal of insulin therapy is to reduce the risk of complications while minimizing weight gain and avoiding hypoglycemia. The best treatment for one person may not work for someone else. Thus it is necessary that patients and their providers create an individualized personal plan that works well for individual patients and fits their lifestyle and personal needs. This approach has a higher chance for success in controlling glucose levels and decreasing the risk of long-term complications.

A wide variety of insulin products are available today. In addition to earlier insulins, insulin analogs have been formulated to improve efficacy, safety, and/or dosing convenience. See Table 3 for the types of insulins and the distinctions between them.

Because there are many possible types and combinations of insulin, and because dosage regimens should be individualized for each patient, there is no universal agreement on specific steps for treatment. Health care providers are responsible for establishing a dosage and titration plan for each patient, preferably done in consultation with the patient and caregivers—taking into account the individual's age, lifestyle, dietary and exercise habits, comorbid conditions, and personal needs or preferences.

To achieve good glycemic control throughout the day, insulin regimens are often complicated, requiring multiple daily injections or CSII. Moreover, many physicians and patients fear hypoglycemia, which leads to many patients not receiving the optimum insulin doses to adequately manage their diabetes.

Many factors including regimen complexity, injection frequency, and weight gain can impede a patient’s ability to manage and control their diabetes.

The majority of insulin users are managed by primary care physicians, who are not usually trained in insulin management. Consequently, insulin is under-prescribed and under-dosed in many cases. Most patients who use insulin do not achieve optimal glycemic control, becoming susceptible to complications. Continuing poor glycemic control and episodes of hypoglycemia indicate a need for improvements in insulin therapy.

Type 1 diabetes
Treatment of type 1 diabetes nearly always begins with insulin, since patients with this type cannot produce their own insulin due to destruction of the beta cells in the pancreas. The approach to dosing and titrating should be individualized as needed. In general, the ADA recommends multiple daily injections (MDI)—with one or two injections of basal per day and prandial insulin prior to each meal—or CSII. Younger children and those in active puberty may not be able to manage MDI or CSII. In these circumstances, twice-daily therapy with an intermediate-acting insulin mixed with a rapid- or short-acting insulin may be appropriate.

CSII is increasing rapidly among patients with both type 1 and type 2 diabetes, particularly in young patients and older adults. Specific indications for CSII are very low insulin requirements (as in very young children), early onset of diabetes, needle phobia, and those experiencing troubles with nocturnal hypoglycemia. Studies of patients using CSII have recorded reductions in both A1C and risk of severe hypoglycemia, and most have shown a significant increase in quality of life.

Self-monitoring of blood glucose (SMBG) and self-titration of insulin dose is well established in type 1 diabetes. In addition to the ADA standards, other organizations such

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**Table 3. Types of insulin**

<table>
<thead>
<tr>
<th>Type</th>
<th>Onseta</th>
<th>Peak effecta</th>
<th>Durationa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid-acting analogs:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin lispro, insulin aspart, insulin glulisine</td>
<td>10–30 min</td>
<td>30–90 min</td>
<td>3–5 h</td>
</tr>
<tr>
<td>Short-acting:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular</td>
<td>30–60 min</td>
<td>2–5 h</td>
<td>5–8 h</td>
</tr>
<tr>
<td>Intermediate-acting:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPH insulin</td>
<td>1–4 h</td>
<td>8 h; 4–12 h</td>
<td>10–16 h</td>
</tr>
<tr>
<td>Long-acting analogs:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin glargine, insulin detemir</td>
<td>1–4 h</td>
<td>Little or no peak</td>
<td>20–26 h</td>
</tr>
<tr>
<td>Pre-mixed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timing depends on proportion of different insulins.</td>
<td></td>
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</tbody>
</table>

*aThese are average times; the onset, peak, and duration vary among different preparations.*
as the AACE and the Endocrine Society have suggested that continuous glucose monitoring (CGM) may be appropriate for patients with type 1 diabetes who do not reach their recommended A1C target due to wide fluctuations in blood glucose throughout the day or who have hypoglycemia unawareness.\textsuperscript{36,37,38} CGM systems have proven to be of clinical value in terms of improving A1C without increasing hypoglycemia with long-term use. Thus CGM is seen as an important advance that can facilitate optimal glucose control in patients with type 1 diabetes.\textsuperscript{36}

**Type 2 diabetes**

When oral medications at maximum tolerated doses do not achieve or maintain target glycemic goals over a 3-month period, insulin therapy may be added to the regimen for patients with type 2 diabetes. Insulin may also be considered at the outset for newly diagnosed patients with type 2 diabetes with symptoms and elevated blood glucose levels.\textsuperscript{3,11} A U.K. survey found that more than one-half of patients diagnosed with type 2 diabetes will need insulin therapy within 6 years of starting their initial treatment for diabetes. This is due to the progressive nature of type 2 diabetes; beta-cell function in the pancreas deteriorates over time, thus leading to deterioration in glycemic control.\textsuperscript{1,35}

Insulin supplementation in patients with type 2 diabetes aims to achieve good glycemic control with a reduction in microvascular disease and, if possible, macrovascular disease, while minimizing hypoglycemia and weight gain.\textsuperscript{1,12} Adding a basal or premixed insulin to current oral antidiabetes medications is considered the easiest way to start insulin therapy in patients with type 2 diabetes.\textsuperscript{29,40} As with type 1 diabetes, there are many recommendations for dosing and titrating insulin, but there is no uniform consensus among experts and professional organizations about the optimal approach.\textsuperscript{39}

In addition to basal-only approaches, basal-bolus regimens, including the use of premixed insulins as well as the “basal plus” strategy that adds incremental prandial insulin injections, have been shown to improve glycemic control.\textsuperscript{30}

### Table 4. Glycemic goals by age group\textsuperscript{2,33}

<table>
<thead>
<tr>
<th>Age</th>
<th>A1C Goal</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toddlers and preschoolers (up to age 6)</td>
<td>&lt; 8.5%</td>
<td>Vulnerability to hypoglycemia, insulin sensitivity, Unpredictability of dietary intake and activity</td>
</tr>
<tr>
<td>School age (6–12)</td>
<td>&lt; 8%</td>
<td>Vulnerability to hypoglycemia, low insulin sensitivity during puberty</td>
</tr>
<tr>
<td>Adolescents and young adults (13–19)</td>
<td>&lt; 7.5%</td>
<td>Transition to adult care, must become more responsible for their diabetes care</td>
</tr>
<tr>
<td>Adults (20–65) who are motivated and otherwise healthy</td>
<td>&lt; 7%</td>
<td>Tight glycemic control may not be appropriate for patients with hypoglycemia unawareness or eating disorders</td>
</tr>
<tr>
<td>Adults (65 and older) who have diabetes-related complications, dementia or other cognitive impairment, or difficulty regularly monitoring blood glucose</td>
<td>&lt; 8% or higher</td>
<td>Tight glycemic control has been shown to increase mortality in older adults with comorbid cardiovascular disease</td>
</tr>
</tbody>
</table>

**Barriers to insulin initiation in type 2 diabetes**

Many patients are reluctant to initiate treatment with insulin because they worry about hypoglycemia and weight gain. The complexity of the insulin regimen and the frequency of injections further contribute to their hesitancy.\textsuperscript{39} Other barriers include injection phobia and impact on social life and work.\textsuperscript{40}

Physicians’ barriers to initiating insulin therapy include concerns about potential adverse effects (particularly hypoglycemia and weight gain) and practical concerns such as patient anxiety, perceived adherence issues, and difficulties in training patients to administer insulin.\textsuperscript{13,14,41}

See the recommended glycemic goals according to age group in Table 4.

**Special considerations for children and adolescents**

Insulin therapy is often initiated when children and adolescents are diagnosed with type 2 diabetes, particularly when the A1C is greater than 9%. The distinction between type 1 and type 2 diabetes is often unclear in this age group.\textsuperscript{2,12}

When initiating insulin therapy, physicians take into account age and the risk of hypoglycemia in young children. Most children under the age of 6 or 7 have a form of hypoglycemia unawareness. They do not feel or recognize the symptoms of hypoglycemia or cannot communicate such symptoms to their caregivers. Children under age 5 are at risk for permanent cognitive impairment if they experience repeated episodes of severe hypoglycemia.\textsuperscript{2}

**Tool Tip: Dawn phenomenon**

Dawn phenomenon is an increase in blood glucose that occurs in the morning due to a surge of hormones that the body produces around 4:00 am or 5:00 am. Everyone experiences this phenomenon, but patients with diabetes do not have a normal counter-regulatory response. This often leads to an increase in fasting glucose levels. Many experts recommend insulin use earlier for patients with type 2 diabetes who show this pattern.\textsuperscript{42} Steps that may help include eating a smaller dinner earlier in the evening and doing some activity after dinner (e.g., going for a walk).\textsuperscript{43}

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Titration

Once treatment is initiated, dose titration is important for success. In the commonly used “treat-to-target” titration regimen, adjustments are linked to the patient’s fasting blood glucose levels prior to breakfast, typically with a target of 130 mg/dl or lower.14,46 Many experts favor self-titration. This strategy empowers patients to be more involved in their therapy, allows for more rapid adjustment of the insulin dose than provider-directed titration schemes, and reduces the burden on the health professional.44

Multiple clinical trials have shown that frequent titration of insulin doses is a key element for successful outcomes.31 The process of insulin titration is complex and governed by two opposing forces: achieving good glycemic control and avoiding hypoglycemia. Just as the initial doses of insulin must be individualized, so must the titration schedule.31 Most patients can be taught to titrate their own insulin dose based on a personalized algorithm. SMBG is essential to such an approach.11 Clinical studies that employed various algorithms for self-titration have validated the safety and effectiveness of this approach with low rates of hypoglycemia.35

What is the recommended titration algorithm?

Because treatment regimens are often complex and should be tailored to the individual patient, there is not one titration algorithm that fits all patients. Also, adjustments in dose vary with different insulin preparations. Generally, the dose is titrated upward if blood glucose levels are not declining and titrated downward if hypoglycemia occurs.14 You can examine the AACE titration algorithm at www.aace.com/files/aace_algorithm.pdf.

Adherence

As for those with most chronic conditions, adherence with medications and self-monitoring recommendations can be challenging for patients with diabetes. Adherence issues, including dose omission, are common and associated with some of the same barriers to initiating insulin treatment, such as hypoglycemia and weight gain.13,46 Poor medication-taking behavior has been shown to significantly increase A1C levels.46

Poor adherence with insulin therapy has been associated with health professionals failing to provide training or answer questions about insulin’s risks and benefits. Poor communication may also be an issue when patients on insulin fail to titrate or intensify their treatment adequately. Therefore, glycemic control can be significantly improved by facilitating ongoing communication with patients and caregivers.13

Mealtime considerations

Patients with diabetes should work with their health care provider or dietitian to create a meal plan that works with their schedule, helps control weight gain, and improves blood glucose, blood pressure, and cholesterol. It is important for patients to understand how different foods and the amounts eaten affect glucose levels.47

In addition to following meal plans and monitoring carbohydrate intake, additional mealtime considerations may help stabilize the balance between glucose and insulin. Here are some pointers:

- Missing or delaying meals may cause hypoglycemia.44
- Skipping or delaying meals or changing the amount or kinds of food eaten can cause problems with blood glucose control.48
- If lunch or dinner is going to be later than usual, eat a fruit or starch serving planned for that meal at the usual mealtime.47
- Counting carbohydrates to adjust bolus doses may be well suited to willing, capable patients with variable meal patterns.28
- If dinner will be very late, eat a snack at the usual dinner time, and eat the full dinner at the later hour. This may require an insulin adjustment.47
- Patients with the dawn phenomenon may reduce its effects by eating dinner earlier in the evening and engaging in some form of physical activity after dinner (such as walking).43

How can pharmacists help with insulin management?

Pharmacists are uniquely placed to provide education and diabetes management services. Many have established education- or diabetes-related sections in the pharmacy. As a trusted source of information, pharmacists can play a vital role in the care of their patients, particularly those using insulin.29

Pharmacists can influence patients’ success by asking about their glycemic goals at every encounter, making sure they fully understand their treatment plan and dose titration schedule, reviewing injection techniques, inquiring about their SMBG practices, and asking whether they are experiencing hypoglycemia.

Is ABM right for your pharmacy?

Hundreds of community pharmacies across the country have implemented the appointment-based model (ABM) of pharmacist care to help provide better care to patients with diabetes. Not only are these pharmacists seeing improvements in medication adherence and better relationships with their patients, they are also reporting improved efficiency and workflow.49 More information and an implementation guide for the ABM of patient care is available from the APhA Foundation at www.aphafoundation.org/appointment-based-model.

Tips for pharmacist counseling and education

There are many ways in which pharmacists can help improve care for their patients with diabetes, either formally (as certified diabetes educators) or informally. Here are some suggestions:

- Help prevent insulin errors.
- Make sure patients know the name(s) of their insulin(s) and how each works.
- Reinforce patients’ understanding of hypoglycemia—what causes it, how to prevent it, and how to manage it if it occurs.14
Remind patients of the benefits of good glucose control—The DDCT and EDIC studies have demonstrated that good glucose control has shown the following benefits in patients with type 1 diabetes:

- Eye disease – 70% risk reduction
- Nerve disease – 60% risk reduction
- Kidney disease – 50% risk reduction
- Any cardiovascular event – 40% risk reduction

Check for drug interactions—Many medications that a patient may be taking concurrently with insulin can affect glucose metabolism or increase the risk of hypoglycemia.50

Ask about missed doses—Whether intentional or accidental, missing a dose can lead to increases in blood glucose. Advise patients that if they miss a dose, they should take it as soon as they remember. However, they should skip the missed dose if it is almost time for the next scheduled dose. They should not use extra insulin to make up the missed dose.50

Talk with teenagers about diabetes management—Emphasize that teens with diabetes must become increasingly responsible for their diabetes care, including self-management. During the teens and early adulthood, there may be fluctuations in glycemic control, increased complications, psychosocial-emotional-behavioral issues, or emergence of chronic complications. Parents should also be informed that their child will likely experience changes in insulin sensitivity related to sexual maturity and physical growth. Inform teenaged patients with type 1 diabetes about their coming transition to adult care. This should begin in early to mid-adolescence, at least one year prior to the transition.7

Identify patients with adherence problems—As with most chronic conditions, medication adherence can be an issue for patients with diabetes. In addition to inquiring about a patient’s dosage schedule, pharmacists can identify adherence problems by reviewing refill records to determine if prescriptions are being filled in a timely manner, and then determine whether an intervention is needed.13

Conclusion

As the prevalence of diabetes increases and more insulin products become available, engaging with patients is essential to helping them achieve their glycemic goals. There is no universally accepted standard for dosing insulin; instead, providers must create an individualized dosing plan for patients based on their specific needs. There is also a growing trend toward patient self-titration based on home glucose monitoring results. Pharmacists are in an excellent position to assist patients in implementing and sticking to their treatment plans, to address concerns about hypoglycemia and weight gain, and to provide feedback regarding progress toward patients’ glycemic goals.

References


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CPE UNDERSTANDING INSULIN MANAGEMENT

CPE Assessment
Instructions: This exam must be taken online; please see “CPE information” for further instructions. The online system will present these questions in random order to help reinforce the learning opportunity. There is only one correct answer to each question.

1. The primary aim of glycemic management in diabetes is to
   a. Lower A1C by 1% in 3 months.
   b. Lower the risk of the complications of diabetes.
   c. Reduce blood glucose to <4 mmol/L.
   d. Assist all patients in achieving normal A1C of <7%.

2. Achieving target glycemic goals
   a. Reduces the risk of retinopathy by 70% or more.
   b. Benefits people with type 2 diabetes more than those with type 1 diabetes.
   c. Does not affect the risk of nephropathy.
   d. Reduces the risk of cardiovascular events by 25%.

3. The types of insulin available today include
   a. Insulin tablets.
   b. Inhaled insulin.
   c. Pre-mixed insulins.
   d. Generic insulins.

4. Intensive insulin therapy, or tight control, is indicated for
   a. Children under the age of 7.
   b. Elderly patients.
   c. Young adults with type 1 or type 2 diabetes.
   d. People with cardiovascular disease.

5. Insulin was discovered by Canadian researchers in
   a. 1869.
   b. 1916.
   c. 1922.
   d. 1936.

6. Adolescents with type 1 diabetes
   a. Are at risk for cognitive impairment after severe hypoglycemia.
   b. Usually transition smoothly into adult care regimens.
   c. Have fewer episodes of hypoglycemia than younger patients.
   d. Will likely experience changes in insulin sensitivity as they grow and mature.

7. Intensive glycemic management has been shown to
   a. Reduce the risk of cardiovascular events in patients with type 2 diabetes.
   b. Increase mortality in patients with type 2 diabetes.
   c. Improve outcomes in high-risk patients with comorbid heart disease.
   d. Decrease episodes of hypoglycemia.

8. Adults with type 2 diabetes
   a. Are unlikely to need insulin during their lifetime.
   b. Should receive insulin when noninsulin therapy at maximal tolerated doses does not achieve or maintain their A1C target.
   c. Will experience less hypoglycemia if they are on intensive glycemic control.
   d. Should not receive insulin if their A1C is 7.5% at diagnosis.

9. Which of the following is a correct statement about hypoglycemia?
   a. It is less common among patients on a tight control regimen.
   b. It occurs when blood glucose levels are higher than normal.
   c. It can result from missing or delaying meals.
   d. It is associated with older patients whose body mass index is very high.

CPE information
To obtain 2.0 contact hours (0.2 CEUs) of CPE credit for this activity, you must complete the online Assessment and Evaluation. A Statement of Credit will be awarded for a passing grade of 70% or better on the Assessment. You will have two opportunities to successfully complete the CPE Assessment. Pharmacists who successfully complete this activity before March 1, 2017, can receive CPE credit. Your Statement of Credit will be available upon successful completion of the Assessment and Evaluation and will be stored on CPE Monitor for future viewing/printing.

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3. To receive CPE credit, select Enroll Now or Add to Cart from the left navigation and successfully complete the Assessment (with randomized questions), Learning Evaluation, and Activity Evaluation.
4. To get your Statement of Credit, click “Claim” on the right side of the page. You will need to provide your NABP e-profile ID number to obtain and print your Statement of Credit.

Live step-by-step assistance is available Monday through Friday from 8:30 am to 5:00 pm ET at APhA Member Services at 800-237-APhA (2742) or by e-mailing education@aphanet.com.
10. **People with diabetes**  
a. Are less likely to die from pneumonia than people who do not have diabetes.  
b. Are two to four times more likely to have a stroke than those without diabetes.  
c. Are at low risk of developing neuropathy.  
d. Seldom develop hypertension.

11. **Intensive treatment of diabetes requires patients to**  
a. Test blood glucose levels twice a day.  
b. Call their health care providers weekly.  
c. Follow a diet and exercise plan.  
d. Inject insulin no more than twice a day.

12. **The landmark Diabetes Control and Complications Trial showed that**  
a. Intensive therapy delays the onset of complications in patients with type 1 diabetes.  
b. Conventional therapy is as effective as intensive therapy.  
c. Intensive therapy of patients with type 2 diabetes stops the progression of retinopathy.  
d. Patients in the trial had a low incidence of hypoglycemia.

13. **Patients can handle the challenges that accompany mealtime by**  
a. Taking intermediate-acting insulin to control blood glucose levels.  
b. Monitoring their carbohydrate intake.  
c. Skipping a snack.  
d. Replacing lunch with a snack.

14. **Which of the following is a correct statement about insulin product onset and duration of activity?**  
a. Activity of short-acting insulin begins no sooner than 30 minutes.  
b. Intermediate-acting insulin acts within 1–4 hours.  
c. The activity of long-acting insulin analogs peaks at 8 hours.  
d. Rapid-acting insulin lasts for less than 3 hours.

15. **Which one of the following is a microvascular complication of diabetes?**  
a. Arteriosclerosis  
b. Stroke  
c. Peripheral vascular disease  
d. Neuropathy

16. **The initial dosing regimen of insulin for patients with type 2 diabetes**  
a. Depends on patient-related variables such as current level of glycemic control, age, and willingness to perform SMBG.  
b. Uses the basal-bolus approach.  
c. Is based on the use of premixed insulins.  
d. There is no “one size fits all” protocol for initial insulin dosing.

17. **Frequent insulin dosage adjustments, called titration,**  
a. Are key to successful outcomes.  
b. Should be done daily.  
c. Are based on a patient’s post-prandial blood glucose levels.  
d. Should be repeated until fasting blood glucose levels reach 140 mg/dL.

18. **Premixed insulin analogs are suitable for type 2 patients who**  
a. Are at low risk of hypoglycemia.  
b. Have a fixed daily routine.  
c. Regularly perform SMBG.  
d. Have variable meal patterns.

19. **An increase in blood glucose levels that occurs due to a surge of hormones early in the morning**  
a. Is due to decreased fasting glucose levels.  
b. Is called the dawn phenomenon.  
c. Can be controlled by oral antidiabetic medications.  
d. Is often caused by eating dinner late in the evening.

20. **Patients who are least likely to adhere to insulin therapy include those who**  
a. Fear hypoglycemia and weight gain.  
b. Possess a good understanding of the risks and benefits of insulin.  
c. Have a good relationship with their health care providers.  
d. Wish to achieve and maintain glycemic targets.