



From Knowledge to Action: Mealtime Insulin

Facilitator Guide

From Knowledge to Action: Mealtime Insulin

Facilitator Note:

This facilitator guide, along with its accompanying visual aid, serves as an informative and interactive tool to help diabetes care and education specialists (DCESS) discuss mealtime (prandial) insulin with adults living with type 1 or type 2 diabetes. Such conversations are particularly important when a healthcare provider recommends starting mealtime insulin, but the person isn't ready, when someone begins mealtime insulin, or when addressing challenges following initiation. The toolkit aims to boost skills, knowledge, and understanding to support improved glycemic management.

Here are a few points to consider when using this toolkit:

- You can describe key points or ask participants questions to have a conversation. Each section of this guide (A–F) includes the key points covered and a separate section with suggested questions to get a conversation going about that same content. (Note: Answers to questions that are asked in each section can be found in the content areas in both the facilitator guide and in the visual aid.)
- The visual aid can be used either by explaining the content on each puzzle piece as you describe or discuss it, or by asking participants to describe and discuss each puzzle piece themselves.
- The guide can be used in any order, based on participant needs.
- Some diabetes care and education specialist prefer their own dialogue when having discussions with their participants. *Please read through this guide and/or reference it, and or understand it and synthesize it in your own voice. You can use the visual aid however you find it most useful for your participants.*
- Insulin is offered in both injectable and inhaled forms. For additional information regarding inhaled insulin, refer to page 17.



You can add other materials you like to use to the visual aid. For more resources about the individual sections of this visual, please visit the **American Diabetes Association® Participant Education Library** professional.diabetes.org/clinical-support/patient-education-library.

At each visit with people taking insulin, evaluate whether their current insulin dose and administration practices remain appropriate. Consider individual factors (e.g., social determinants of health) and clinical indicators, including potential signs of overbasalization, to determine if adjustments are necessary. Assess whether a change in administration method, such as transitioning to or from multiple daily injections, automated insulin delivery, or inhaled insulin, would better meet the person's needs.

To Participant:

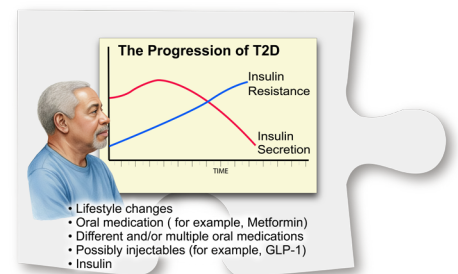
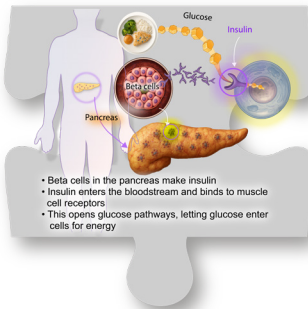
The picture in this visual aid resembles a puzzle. There are many things to consider when making decisions about mealtime insulin and, just like puzzle pieces, often integrate closely with each other. The central goal is achieving target blood glucose levels. Mealtime insulin can help maintain your target range, improve A1C, promote well-being, and reduce acute and long-term complication risks.

A. Pathophysiology of Type 1 Diabetes and Type 2 Diabetes

Facilitator Note:

As a diabetes care and education specialists, it's essential to help participants understand how the underlying pathophysiology of type 1 and type 2 diabetes directly informs the need for mealtime insulin. In type 1 diabetes, the absence of endogenous insulin production means daily replacement is vital, while in type 2 diabetes, progressive insulin resistance and beta cell dysfunction often lead to the need for supplemental insulin over time. Mealtime (prandial) insulin is a key tool for managing post-meal blood glucose spikes and supporting individualized glycemic targets. Chronic issues that affect insulin absorption are also briefly discussed.

Visual aid puzzle pieces focused on in this section:



Facilitator Tip: Always start by referencing and describing the information on the visual aid puzzle piece being discussed. In this section, they are the puzzle pieces across the top of the visual aid. You can also ask participants to describe what is on the relevant puzzle piece.

The main topics that can be covered in this section include:

To Participant:

» Using insulin in diabetes: (Refer to Visual)

- In type 1 diabetes, there is a complete lack of insulin production, requiring daily insulin replacement therapy to sustain health and life.
- In type 2 diabetes, the condition is progressive as muscle cells become increasingly more resistant to insulin. Insulin production may initially be sufficient but declines over time due to beta cell dysfunction in the pancreas, often necessitating supplemental insulin for blood glucose management.

» **Mealtime (prandial) insulin:**

- The pancreas has beta cells that create insulin. Eating carbohydrates triggers insulin production.
- Insulin is a hormone that regulates glucose metabolism by facilitating the absorption of glucose from the bloodstream into the cells for energy use. After a meal, the liver stores excess glucose as glycogen. When blood glucose levels drop, the liver reacts by breaking down glycogen and releasing glucose back into the blood.
- As beta cell function declines, additional insulin support becomes necessary for effective blood glucose management. When someone with reduced beta cell function consumes carbohydrates, their blood glucose levels rise more sharply than before, reflecting the progressive nature of diabetes. All individuals with type 1 diabetes require mealtime insulin in some form.
- Many with type 2 diabetes also benefit from mealtime insulin to meet their glucose management goals.

» **Factors influencing blood glucose levels:**

- Fluctuations depend on the body's natural insulin response after eating, types of foods consumed (e.g., carbohydrates alone vs. mixed meals), food order, gastric emptying rate, and presence of coexisting conditions. Insulin also inhibits glucose production in the liver (known as glycogen-related processes).
- Insulin also inhibits glucose production in the liver (known as glycogen-related processes).

Possible question to ask a person with diabetes to discuss the topics covered in this section:

1. How do you think your pancreas is involved in managing your blood glucose levels?
2. For people with type 1 diabetes, why do you think insulin injections are needed every day?
3. For people with type 2 diabetes, what is the reason that glucose levels rise over time?
4. Do you have any questions about how diabetes works or about type 1 or type 2 diabetes that you would like to discuss?

B. The Goals of Managing Your Diabetes

Facilitator Note:

This section emphasizes the importance of helping people with diabetes achieve and maintain individualized blood glucose targets, A1C goals, and thus overall wellbeing. As an DCES, you play a key role in guiding participants to understand how mealtime insulin supports these objectives—by managing blood glucose spikes after meals, sustaining time in range, and reducing the risk of long-term complications. The content encourages DCESs to use visual aids and conversation starters to clarify these concepts, empowering participants to take an active role in their diabetes management and make informed decisions about mealtime insulin.

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The main topics that can be covered in this section include:

To Participant:

- » **Blood glucose/time in range:** Achieve and sustain individualized blood glucose levels within a target range to support daily functioning and prevent extreme highs (hyperglycemia) or lows (hypoglycemia).
- » **A1C:** Maintain A1C (a measure of average blood glucose over the past two to three months) within recommended individualized targets to reflect consistent blood glucose management.
- » **Enhance overall wellbeing and how you feel:** Promote physical and emotional health by minimizing symptoms like fatigue, thirst, or mood swings associated with fluctuating blood glucose levels.
- » **Improving your health outcome:** Maintaining blood glucose in your target range and A1C below 7 (for most people with diabetes) can reduce the risk of long-term diabetes-related complications, such as heart disease, kidney disease, retinopathy (eye damage), neuropathy (nerve damage), and vascular issues.

Possible question to ask a person with diabetes to discuss the topics covered in this section:

1. What do you do to maintain your blood glucose levels in your target range each day?
2. Have you heard of A1C? What does it mean to you, and how do you keep track of it?
3. Do you feel any different when your blood glucose is within your target range compared to when it is not?

Facilitator Tip: Note that some people don't feel any different if their blood glucose is high. As a matter of fact, they may feel worse when they start maintaining their blood glucose in or closer to their target range.

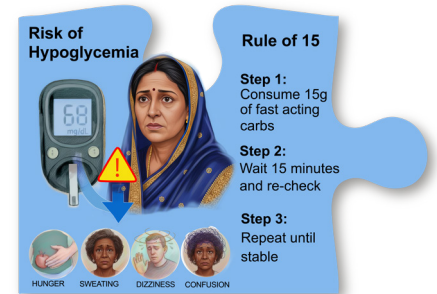
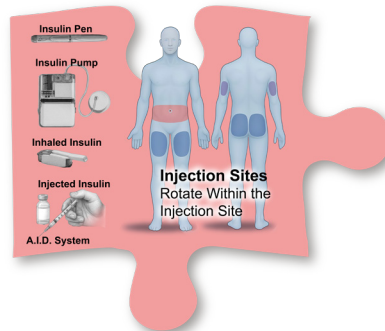
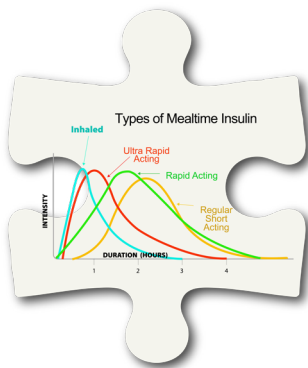
4. How can diabetes affect your heart, kidneys, or eyes over time?
5. What steps do you take to stay healthy and avoid long-term problems from diabetes?
6. What healthy habits help you feel good and manage your diabetes day to day?
7. How confident do you feel about managing your diabetes on your own. What support do you need?

C. Medications and Acute Complications

Facilitator Note:

This section provides an overview of mealtime insulin types, their onset, peak, and duration, and highlights practical considerations for safe and effective use. It covers delivery methods (injections, pumps, automated insulin delivery systems, inhaled insulin), site rotation, and potential side effects such as hypoglycemia. The guidance emphasizes the importance of individualized care, regular blood glucose monitoring, and strategies for managing insulin during travel. DCEs can use this information to facilitate conversations that help participants understand how mealtime insulin works, how to prevent complications, and how to tailor insulin therapy to each person's needs.

Visual aid puzzle pieces focused on in this section:



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The main topics that can be covered in this section include:

To Participant:

» **Types of mealtime insulin:**

Mealtime insulin varies by **onset** (when it starts working), **peak** (when it's most effective), and **duration** (how long it lasts).

	Regular Insulin	Rapid-acting Insulin	Ultra Rapid-acting Insulin	Inhaled Insulin
Onset	30–60 minutes	15–30 minutes	~20 minutes	~12–15 minutes
Peak	2–3 hours	~1–2 hours	~90 minutes (is typically dose-de- pendent)	~35–45 minutes (is dose- dependent)
Duration	6–8 hours (inject ~30 minutes before meals)	~3–5 hours (inject ~15 minutes before eating)	~4–5 hours (inject at mealtime)	~1.5–3 hours (administer at meals)
Product Examples		aspart, lispro, and glulisine	Fiasp, faster acting aspart, Lyumiev, and ultra-rapid lispro	

» **Delivery methods for insulin:**

- Injections: Administered via syringes or insulin pens into subcutaneous tissue (commonly abdomen, thighs, or upper arms).
- Insulin pumps: Delivers mealtime insulin for convenient use in type 1 diabetes and type 2 diabetes.
- Automated insulin delivery (AID) systems: Delivers mealtime insulin as above (see insulin pumps) but also connects with continuous glucose monitoring (CGM) systems for optimal blood glucose control. AIDs usually require some input from the user.
- Inhaled insulin: Rapidly absorbed through the lungs, offering an alternative for those who prefer not to inject.

» **Injection site rotation:**

- Insulin absorption varies by site: Fastest in the abdomen, slower in upper arms, and slowest in thighs/buttocks.
- Consistent use of one area (e.g., abdomen) ensures predictable absorption, but rotating sites within that area prevents lipohypertrophy (fatty tissue buildup) or scar tissue, improving glucose management consistency.

» **Potential side effects:**

- Risk of hypoglycemia:
 - Mealtime insulin increases the risk of low blood glucose (<70 mg/dL), with symptoms like hunger, confusion, dizziness, or sweating.
 - Monitor blood glucose using a blood glucose meter or continuous glucose monitor as advised by your care team.
 - Treat non-severe hypoglycemia with the 15-15 rule: Consume 15 grams of fast-acting carbohydrates, recheck after 15 minutes, and repeat until blood glucose is >70 mg/dL or is trending up on a CGM, followed by a protein/carb snack. (Note: There are examples of fast-acting 15-g carbohydrates in the associated take home tool.)
 - Carry glucagon for severe hypoglycemia and understand “insulin action time” and “insulin stacking” to avoid overdosing, which can heighten hypoglycemia risk.
 - Active insulin time, also called duration of insulin action (DIA), refers to how long a dose of insulin continues to lower blood glucose levels.
 - Insulin stacking occurs when additional insulin doses are taken too soon after a previous dose, potentially causing dangerously low glucose (hypoglycemia).

Facilitator Tip: Glucagon is a hormone made by the pancreas that raises blood glucose levels. When blood glucose is low, glucagon signals the liver to release stored glucose into the blood to give your body energy. For people with diabetes, a glucagon emergency kit is a tool to treat dangerously low blood glucose by providing a fast-acting way to raise glucose levels when they are unable or unwilling to consume an oral carbohydrate to raise their blood glucose level.

» **Inhaled insulin side effects:**

- May cause coughing, throat pain, or irritation. It is not suitable for those with lung conditions (e.g., asthma or COPD). Lung function monitoring may be required.

» **Individualized care:**

- Consult your diabetes care team to tailor insulin dose, timing, and delivery method to your specific needs for optimal blood glucose management.

» **Storage of mealtime insulin:**

- Unopened insulin pens, vials, and inhaled powder cartridges should be stored in the refrigerator (36–46 degrees F) until the expiration date.

- Opened insulin vials and pens may be stored at room temperature. Vials typically remain effective for 20–28 days, while pens last about 28–30 days, depending on the insulin type. Always store the insulin pens with the cap on to protect it from light and heat.
- For inhaled insulin, opened foil packages should be used within 10 days. For more details, please refer to page 17.
- Insulin doesn't work well in extreme temperatures (less than 36 degrees F, greater than 86 degrees F). If using an automated insulin delivery (AID) device, stay below 98.6F

» **Traveling with mealtime insulin:**

- Insulin does not need to be refrigerated when traveling.
- If temperatures are expected to exceed 86 degrees F or drop below freezing, insulin should be stored in an insulated container, such as a thermos.
- Carry insulin and diabetes supplies in your carry-on bag. Avoid placing them in checked luggage, as it may get lost or be exposed to extreme temperatures.

Possible question to ask a person with diabetes to discuss the topics covered in this section:

1. What do you know about how different types of insulin work, like when they start and peak, and their duration or when they stop working?
2. How do you time your mealtime insulin with your meals? Has your diabetes team given you specific advice on this?
3. Are you currently taking insulin? If yes:
 - Have you tried different ways to take insulin?
 - Have you or anyone tried insulin injections?
 - Have you or anyone tried an insulin pump?
 - Have you or anyone tried inhaled insulin?
 - What are your thoughts on insulin?
 - When you inject insulin, do you switch up the spots you use, like your stomach, arms, or thighs?
4. Have you ever had low blood glucose after taking mealtime insulin? What were your signs and symptoms and what did you do to raise your blood glucose?
5. If you are on inhaled insulin, did you have any side effects?
6. How do you check your blood glucose to make sure your mealtime insulin is working right for you?
7. Do you know about “active insulin time” or “insulin stacking”? How do you make sure you’re not taking too much insulin too soon?
8. Have you ever used glucagon for low blood glucose emergencies? Do you feel prepared to use it if needed? If not, what more do you need to learn about it?

D. Healthy Eating and Monitoring

Facilitator Note:

This section highlights the critical role of carbohydrate intake and insulin dosing in diabetes management. It explains how matching mealtime (prandial) insulin doses to carbohydrate consumption helps minimize blood glucose variability after meals and maintain target ranges. The insulin-to-carbohydrate ratio (ICR) is introduced as a practical tool for personalizing insulin dosing, and DCEs are encouraged to guide participants in applying their ICR and adjusting doses as needed. The section also emphasizes the importance of regular blood glucose monitoring—using BGMs or CGMs—to inform insulin decisions and achieve recommended targets, such as keeping time in range (TIR) at 70% or higher. DCEs are advised to use visual aids and conversation starters to help participants understand these concepts and actively engage in their diabetes care.

Visual aid puzzle pieces focused on in this section:



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The main topics that can be covered in this section include:

To Participant:

- » **Carbohydrate intake and insulin dosing:** The amount of carbohydrates consumed affects blood glucose levels the most. Matching mealtime insulin doses to carbohydrate intake is critical to minimize glycemic variability.
- » **Insulin-to-carbohydrate ratio (ICR):** A formula that estimates how much insulin is required to balance a given quantity of carbohydrates. It assists individuals with diabetes in managing their blood glucose by showing how many grams of carbohydrates one unit of insulin can manage.
- » **Matching mealtime insulin:** Apply your ICR to determine the appropriate dosage of mealtime insulin prior to eating. Administering the correct amount of insulin helps maintain blood glucose within your designated target range. Consult your diabetes care team for guidance on your personalized ratio. Please be aware that this ratio may change over time.

Facilitator Tip: Due to the fast-acting properties of inhaled insulin, a precise carbohydrate count is not strictly necessary for every meal.

- » **Timing of mealtime insulin:** Administer mealtime insulin to align with meal digestion to reduce post-meal hyperglycemia. Only take it when eating unless adjusting for carbohydrate amount or glucose levels. (Note: Gastroparesis or GLP-1 use may delay carbohydrate absorption.)
- » **Monitoring:** Regular blood glucose monitoring using blood glucose meters (BGMs) or continuous glucose monitors (CGMs) helps determine appropriate insulin doses. The target blood glucose levels for most people with diabetes are 80–130 mg/dL before meals/ fasting and <180 mg/dL two hours post-meal. If a person is currently using a CGM, the recommended time in range (TIR) is at least 70%. Always consult your diabetes care team for your personalized blood glucose goals.

Possible question to ask a person with diabetes to discuss the topics covered in this section:

1. When do you take your mealtime insulin? How do you make sure it matches to maintain your blood glucose within your range?
2. Do you use a BGM or a CGM to check your glucose levels? How often do you check before and after meals?

E. Physical Activity

Facilitator Note:

This section explains that physical activity uses blood glucose for energy and improves insulin sensitivity, which can affect glucose levels for up to 72 hours—often overlapping with the action of mealtime insulin. For people using mealtime insulin, DCEs should guide participants in adjusting insulin doses for planned or unplanned activity, monitoring glucose before, during, and after exercise, and taking steps to prevent hypoglycemia. Understanding how physical activity interacts with mealtime insulin is crucial for helping participants maintain safe and effective blood glucose management, optimize insulin dosing, and achieve long-term health benefits.

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The main topics that can be covered in this section include:

To Participant:

» Physical activity:

- Any muscle movement (e.g., exercise, gardening, or mowing) is physical activity which uses blood glucose for energy, improves insulin sensitivity, and continues to affect blood glucose levels within 2–72 hours, often during insulin's peak action.
- Effects vary by activity type, intensity, duration, frequency, and muscle groups. Total weekly activity impacts insulin effectiveness, while high-intensity, short-duration activities may have immediate effects.
- Planned activity may require a reduced mealtime insulin dose. Unplanned activity during insulin peak may require you to eat a snack to prevent hypoglycemia.
- Before physical activity, avoid injecting insulin into muscles that will be actively used, as increased blood flow and higher body temperature can speed up insulin absorption and raise the risk of hypoglycemia.

» **Physical activity precautions:**

- Monitor glucose before, during, and after activity to assess insulin needs.
- Stay hydrated, especially in temperatures above 77 degrees F, to support glucose regulation.
- Wear appropriate clothing, properly fitting shoes (replace every 300–500 miles or 6–12 months), and well-fitting socks to prevent blisters and ensure safety.
- Check feet daily for cuts or blisters, wear medical identification, and identify a support system for hypoglycemia risks.

» **Long-term benefits:**

- Consistent blood glucose management through proper insulin dosing, monitoring, and activity helps you hit your blood glucose targets.

Possible question to ask a person with diabetes to discuss the topics covered in this section:

1. What kinds of physical activities do you do, like exercise or hobbies? Have you noticed how they affect your blood glucose?
2. If you're planning to be active, how do you adjust your mealtime insulin to avoid low blood glucose?
3. Have you ever had low blood glucose during or after activity? What do you do to prevent or treat it?
4. When you inject insulin, do you think about where you're injecting, especially if you're going to be active? Why might that matter?
5. How do you stay hydrated during activities?

F. Healthy Coping, Support, and Diabetes Distress

Facilitator Note:

This section addresses the emotional and practical challenges people with diabetes may face when using mealtime insulin, such as stress, anxiety, and diabetes distress. It highlights the importance of recognizing barriers like fear of injections, reluctance to use insulin in public, and complex routines. DCEs are encouraged to facilitate open conversations, provide support, and introduce advanced diabetes technologies—including inhaled insulin and insulin pumps—that can reduce management burdens. By understanding and addressing these challenges, DCEs can help participants feel more confident and empowered in their use of mealtime insulin, ultimately supporting better self-care and glycemic outcomes.

Visual aid puzzle pieces focused on in this section:



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The main topics that can be covered in this section include:

To Participant:

Mealtime insulin poses ongoing challenges for people with diabetes, particularly over time. Below are some common issues they encounter; utilizing different diabetes technology available may help reduce these difficulties.

- » **Emotional challenges of diabetes:** Living with diabetes can cause stress and anxiety due to the daily demands of self-management. This is in part because of potential barriers to insulin use, such as fear of injection, reluctance to take insulin in public, or complex routines.
- » **Diabetes distress:** This refers to the unique emotional burden and worries from managing diabetes, often called "diabetes burnout." Discussing distress with a diabetes care team is crucial.

- » **Seeking support:** Share feelings of stress or fear with your diabetes care team. They may use brief questions to assess your emotional state and connect you with a behavioral health professional for tailored self-care strategies.
- » **Advanced diabetes technology:** Tools like shorter/thinner needles, faster acting insulin, inhaled insulin (needle-free), insulin pumps, or automated devices can reduce management burdens and improve self-care behaviors based on individual preferences.
- » **Benefits of inhaled insulin:** Inhaled insulin is an option for those struggling with injection pain or fear, scheduling issues, or social stigma, potentially improving medication usage and clinical outcomes.
- » **Personalized care:** Your diabetes care team can help select the best insulin type and delivery method based on your lifestyle, preferences, and safety needs.

Possible question to ask a person with diabetes to discuss the topics covered in this section:

1. How do you feel about the daily tasks of managing your diabetes, like taking insulin or blood glucose monitoring?
2. Does the idea of injecting insulin make you nervous? If so, what worries you the most?
3. Have you ever felt stressed or overwhelmed by your diabetes routine? What does that feel like for you?
4. Have you experienced “diabetes burnout/diabetes distress”? How do you cope when you feel this way?
5. Have you talked to your health care team about any stress or fears related to your diabetes? How did that conversation go?
6. What do you think about using tools like thinner needles, inhaled insulin, or insulin pumps to make managing diabetes easier?
7. How do you feel your diabetes care team supports you in choosing the right insulin or device for your lifestyle?
8. After starting a new insulin or device, how often do you communicate with your care team about your blood glucose levels?
9. What would make you feel more comfortable or confident in managing your diabetes every day?

Inhaled Insulin Overview

- Inhaled insulin is an inhaled powder insulin taken right before a meal. The insulin is rapidly absorbed through the lungs into the bloodstream, where it starts to lower blood glucose levels.
- Available in 4-, 8-, and 12-unit single-use cartridges.
- Cartridges can be combined to match the participant's prescribed dose.
- Inhaled insulin is not a substitute for long-acting (basal) insulin in type 1 diabetes. It must be used together with a basal insulin.
- Not for use in participants with chronic lung diseases (e.g., asthma or COPD) or those who smoke.

» **Tips regarding inhaled insulin:**

- Always administer at room temperature to ensure optimal delivery.
- Participants may experience a cough when beginning treatment. Drinking water before and after inhalation may help reduce this side effect.
- Individuals new to insulin therapy are advised to start with 4 units of Afrezza at each meal.
- For individuals switching from injectable mealtime insulin to inhaled insulin, the initial dose may need to be 1.5 to 2 times higher to achieve a comparable glucose-lowering effect.
- The dosage should be adjusted in collaboration with a health care provider to meet blood glucose targets and individual metabolic requirements.

» **Additional storage information:**

- Unopened foil packages may be stored at room temperature for up to 10 days.
- Once a blister strip is opened, the cartridges should be used within three days.
- Prior to administration, cartridges must be allowed to reach room temperature for 10 minutes and should not be returned to the refrigerator after reaching room temperature.
- Opened inhaled insulin inhalers, use for up to 15 days from the date of first use. Afterwards, the inhaler must be discarded and replaced.

» **Insurance Coverage:**

- Insurance plans differ in what they cover. To find out specific details about coverage, it is important that the participant contact their insurance provider directly.

Get additional resources at:

afrezza.com/wp-content/uploads/2023/03/Instructions-for-Use-Feb-2023.pdf

References

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This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



For additional information, please visit
professional.diabetes.org/erpu