

The background of the slide is a light blue, semi-transparent image. It depicts a hand holding a glass vial with a white cap, and a syringe with a needle. The syringe has markings on its plunger, including 0.2, 0.3, 0.4, 0.5, and 0.6. The overall scene is related to medical or pharmaceutical practice.

# INSULIN 101

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## DISCLOSURES AND CONFLICT OF INTEREST

- Bedrija Nikocecic declares no conflicts of interest, real or apparent, and no financial interests in any company, product, or service mentioned in this program, including grants, employment, gifts, stock holdings and honoraria.



## PHARMACIST OBJECTIVES

At the conclusion of this program, the pharmacist will be able to:

1. Describe steps to correctly prepare and administer insulin
2. Select an appropriate syringe/needle based on patient and therapy specific factors
3. Describe storage requirements for insulin products
4. Discuss sharps disposal options.



## TECHNICIAN OBJECTIVES

At the conclusion of this program, the technician will be able to:

1. Describe how to calculate quantity and day supply that accounts for correct use of injectable diabetes therapies
2. Recognize situations involving insulin products that should be referred to a pharmacist for consultation

## PRE-TEST QUESTION

How often should patients prime prefilled insulin pens?

- A. The first time the pen is used
- B. Every time the pen is used
- C. Once a week
- D. Once a month

## PRE-TEST QUESTION

- KK is a 25 year old male who has been living with T1DM since age 4 years. He currently uses insulin glargine (Lantus) U-100 vial, 38 units QHS and insulin aspart (Novolog FlexPen) U-100 10 units TID. KK states he needs the "shots" to administer Lantus and has plenty of all other supplies.
- Which of the following should you dispense?
  - A. BD Insulin Syringe 31 g 0.5 ml 6 mm
  - B. BD Insulin Syringe 31 g 0.3 ml 4 mm
  - C. Novofine Pen Needle 31 g 4 mm
  - D. Novofine Pen Needle 31 g 6 mm



PRE-TEST  
QUESTION

- Which of the following is an acceptable household container to dispose sharps into?
  - A. Garbage can
  - B. Plastic water bottle
  - C. Glass mason jar
  - D. Plastic detergent bottle

INSULIN





# INJECTABLE INSULIN

7.4 million Americans with diabetes use one or more formulations of insulin

In 2008, insulin accounted for 16% of all medication error events with reported harm

2010: most common medical errors in critical care patients were insulin administration errors

# MARKETED INSULIN PRODUCT FORMULATIONS

- Vial
- Pen
- Pump
- Inhaled insulin



# MARKETED INSULIN PRODUCT FORMULATIONS

Category	Insulin	Product Examples
Rapid acting	Lispro	U-100 vial: Admelog, Humalog, Lyumjev U-100 pen: Admelog SoloStar, Humalog KwikPen, Humalog Junior KwikPen, Lyumjev KwikPen <b>U-200</b> pen: Humalog KwikPen, Lyumjev KwikPen
	Aspart	U-100 vial: Fiasp, Novolog, Novolog ReliOn U-100 cartridge: Fiasp PenFill, Novolog PenFill U-100 pen: Fiasp FlexTouch, Novolog FlexPen, Novolog FlexPen ReliOn
	Glulisine	U-100 vial: Apidra U-100 pen: Apidra SoloStar
	Inhaled insulin	Afrezza®: 4 units, 8 units, 12 units

# MARKETED INSULIN PRODUCT FORMULATIONS

Category	Insulin	Product Examples
Short acting	Human regular	U-100 vial: Humulin R, Novolin R, Novolin R ReliOn U-100 pen: Novolin R FlexPen, Novolin R FlexPen ReliOn <b>U-500</b> vial: Humulin R <b>U-500</b> pen: Humulin R KwikPen
Intermediate acting	Human NPH	U-100 vial: Humulin N, Novolin N, Novolin N ReliOn U-100 pen: Humulin N KwikPen, Novolin N FlexPen, Novolin N FlexPen ReliOn
Long acting	Detemir	U-100 vial: Levemir U-100 pen: Levemir FlexTouch
	Glargine	U-100 vial: Lantus, Semglee U-100 pen: Basaglar KwikPen, Lantus SoloStar, Semglee <b>U-300 pen:</b> Toujeo SoloStar, Toujeo Max Solostar
	Degludec	U-100 vial: Tresiba U-100 pen: Tresiba FlexTouch <b>U-200</b> pen: Tresiba FlexTouch

# MARKETED INSULIN PRODUCT FORMULATIONS

Category	Insulin	Product Examples
Premixed insulin	Lispro protamine/lispro	U-100 vial: Humalog Mix 50/50, Humalog Mix 75/25 U-100 pen: Humalog Mix 50/50 KwikPen, Humalog Mix 75/25 KwikPen
	Aspart protamine/aspart	U-100 vial: Novolog Mix 70/30 U-100 pen: Novolog Mix 70/30 FlexPen
	NPH/Regular	U-100 vial: Humulin 70/30, Novolin 70/30 U-100 pen: Humulin 70/30 KwikPen, Novolin 70/30 FlexPen

## PATIENT CASE

- JC is a 52 year old patient who was recently diagnosed with T2DM . He is presenting to your pharmacy today with a prescription for Lantus Solostar U-100, inject 10 units QHS as directed. Each SoloStar pen has 3 mL of insulin in it. How many pens will you need to dispense to JC if he needs a 28 days supply?
- ANSWER:



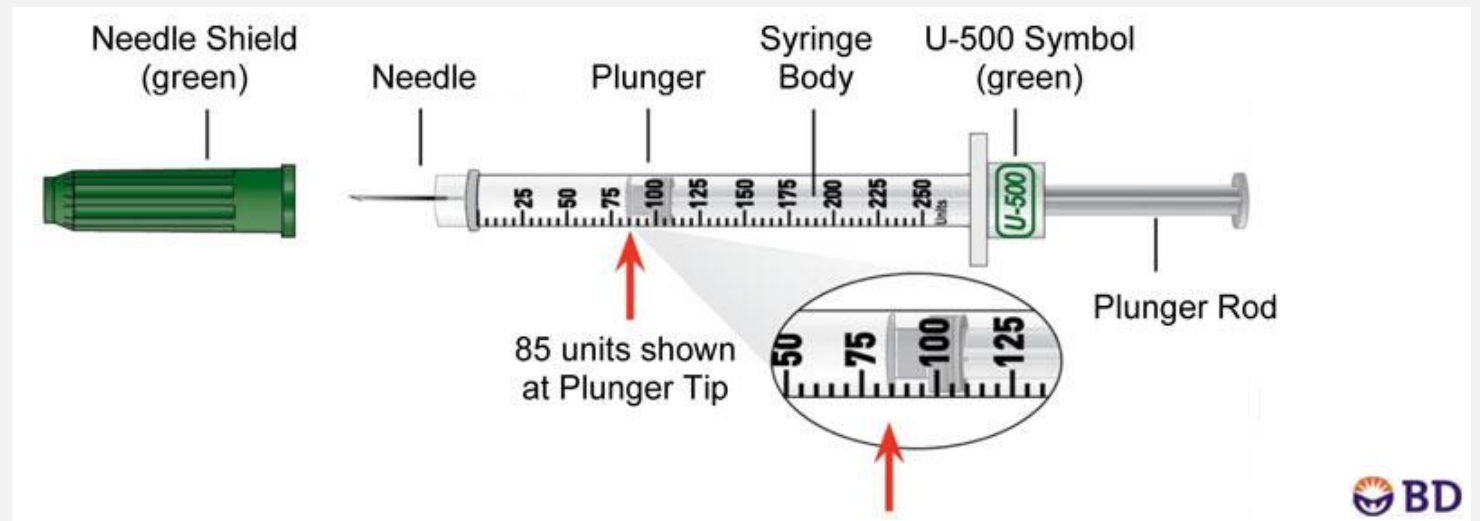
## U-100 INSULIN SYRINGES

- 0.3 ml → 30 units
  - ½ unit markings
  - 1 unit markings
- 0.5 ml → 50 units
- 1 ml → 100 units

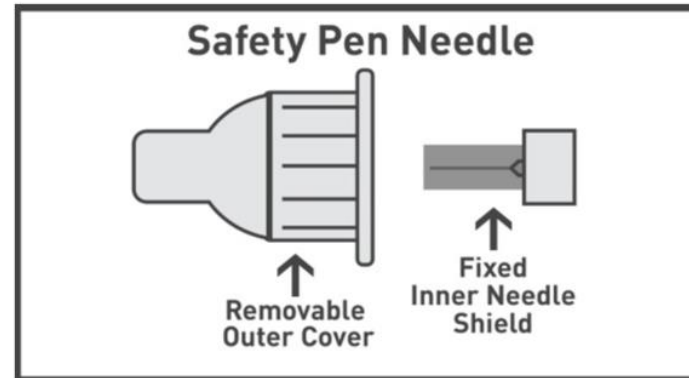
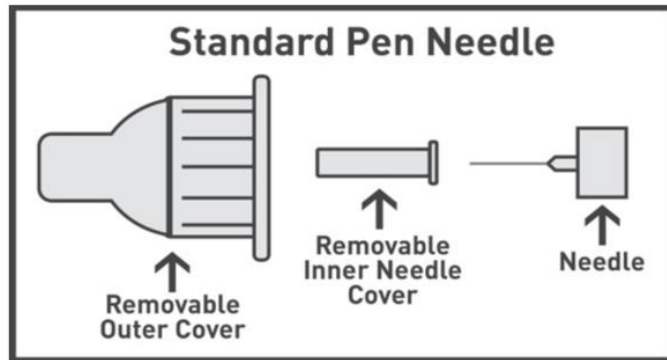


# U-500 INSULIN SYRINGE

- 0.5 ml → 250 units
  - 5 unit markings
- Use only with U-500 insulin







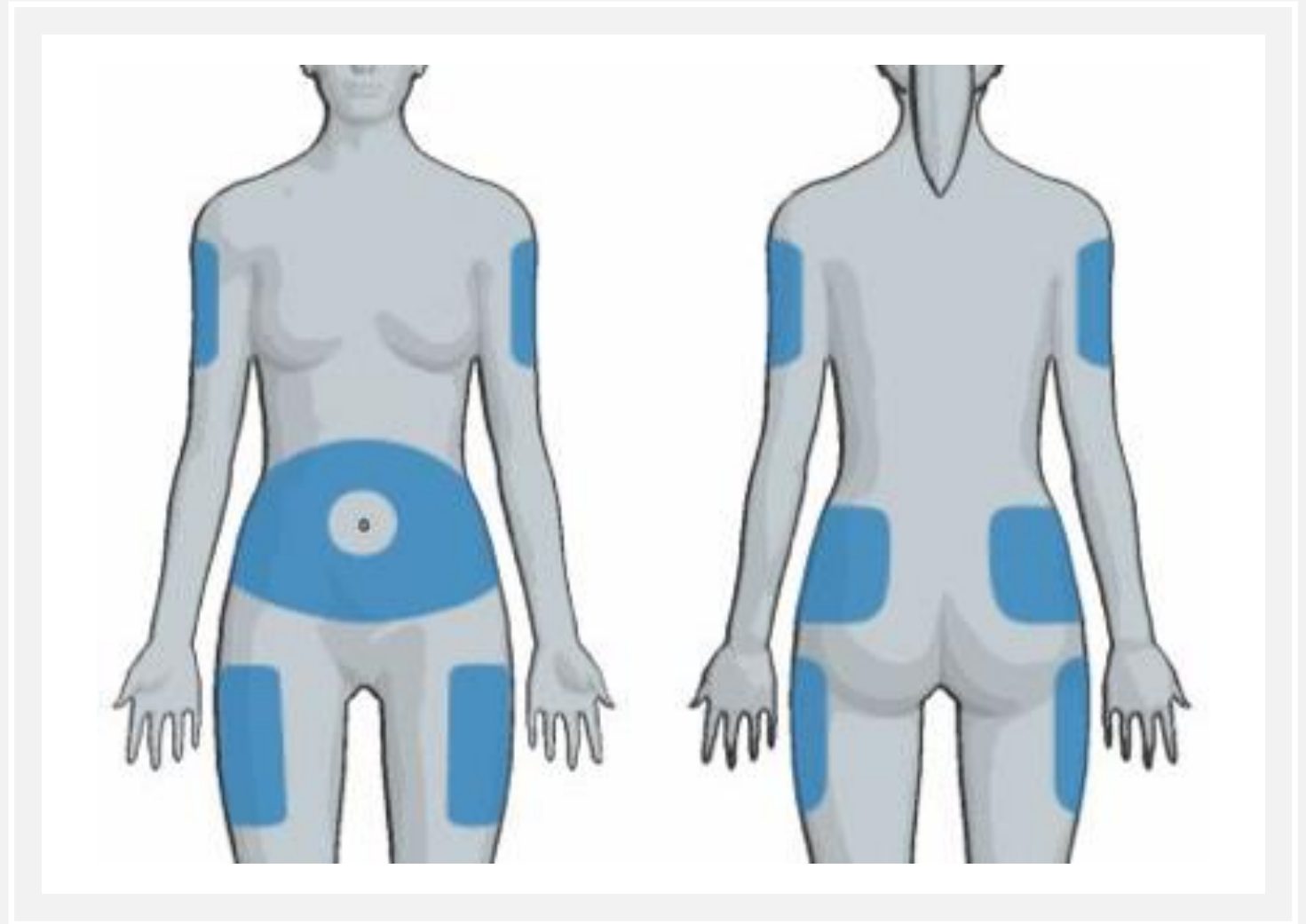
# INSULIN PEN NEEDLES

Becton Dickinson. <https://www.bd.com/en-us/offerings/capabilities/diabetes-care>. Accessed July 27., 2021.

Novo nordisk. <https://www.novoneedles.com/>. Accessed July 27, 2021.

## INSULIN INJECTION SITES

- Abdomen
- Back of upper arms
- Upper buttocks or hips
- Outer side of thighs



# INSULIN VIAL INJECTION TECHNIQUE

- Gather supplies
- Re-suspend intermediate or premixed insulins
- Check insulin for lumps, crystals or discoloration
- Prepare insulin vial
- Pull air into syringe
- Inject air into vial
- Draw insulin
- Check for and expel air bubbles
- Prepare injection site
- Inject into skin at a 90 % angle, administer dose
- Wait 5-10 seconds before removing needle from skin

Needle length >6 mm:

**Injection Technique**  
**Pinch-up technique is required.**  
Pinch up your skin, taking care to fold the top layers and not pull muscle into the fold. Inject straight into the skin fold or at an angle to avoid injecting into the muscle.



The diagram shows two cross-sections of skin. The left one, labeled 'Correct Technique', shows a hand pinching the skin to create a fold that lifts the epidermis and dermis away from the underlying muscle. The right one, labeled 'Incorrect Technique', shows a hand pulling the skin taut, which causes the muscle to be pulled up into the skin fold. A large 'X' is drawn over the incorrect technique.

Correct Technique      Incorrect Technique

Needle length 4-5 mm:

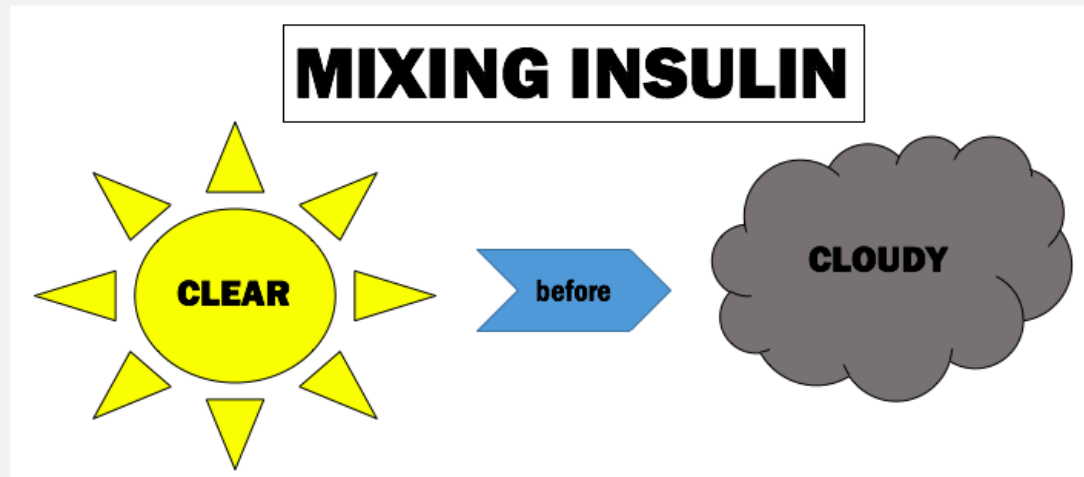
**Injection Technique**  
**No pinch-up technique required.**  
Inject "straight in," at a 90° angle, flush with skin for easy injection at all sites. Hold the needle in the skin while slowly counting up to 10.



The diagram shows a needle being inserted vertically into the skin at a 90-degree angle. The needle is shown penetrating through the epidermis and dermis into the subcutaneous layer. The skin surface is flat and flush with the needle.

# MIXING INSULINS

- Withdraw air for cloudy insulin
- Inject air into cloudy insulin; do not withdraw insulin yet
- Withdraw air for clear insulin
- Inject air into clear insulin and withdraw clear insulin
- Withdraw cloudy insulin
  - Do not overdraw → cannot reinject insulin into vial



# INSULIN PEN INJECTION TECHNIQUE

1. Gather supplies
2. Re-suspend intermediate or premixed insulins
3. Check insulin for lumps, crystals or discoloration
4. Wipe rubber seal with alcohol pad
5. Attach pen needle
  1. Remove outer and inner cover
6. Prime with 2 units before each injection
7. Change needle if needed
8. Dial desired number of units
9. Inject into skin at a 90 % angle, administer dose
10. Wait 5-10 seconds before removing needle from skin
11. Recap needle with outer cover, remove and discard in sharps
12. **\*Use new needle each time\***
13. **\*Do not store pen with needle attached\***

## RAPID ACTING INSULIN PEN DOSING

<b>Insulin Product</b>	<b>Unit Increments</b>	<b>Max Units per Dose</b>	<b>Repeat Priming Steps</b>
Admelog SoloStar	1 unit	80 units	3 times
Humalog KwikPen	1 unit	60 units	4 times
Humalog Junior KwikPen	0.5 unit	30 units	4 times
Lyumjev KwikPen	1 unit	60 units	4 times
Fiasp FlexTouch	1 unit	80 units	6 times
Novolog FlexPen	1 unit	60 units	6 times
Apidra SoloStar	1 unit	80 units	2 times

# SHORT AND INTERMEDIATE ACTING INSULIN PEN DOSING

Insulin Product	Unit Increments	Max Units per Dose	Repeat Priming Steps
<b>Short Acting Insulin Products</b>			
Novolin R FlexPen	1 unit	60 units	6 times
Humulin R KwikPen (U-500) *use only for patients who require >200 units of insulin/day*	5 unit *prime with 5 units*	300 units	8 times
<b>Intermediate Acting Insulin Products</b>			
Humulin N KwikPen	1 unit	60 units	4 times
Novolin N FlexPen	1 unit	60 units	6 times

# LONG ACTING INSULIN PEN DOSING

<b>Insulin Product</b>	<b>Unit Increments</b>	<b>Max Units per Dose</b>	<b>Repeat Priming Steps</b>
Levemir FlexTouch	1 unit	80 units	6 times
Basaglar KwikPen	1 unit	80 units	4 times
Lantus SoloStar	1 unit	80 units	2 times
Semglee	1 unit	80 units	3 times
Toujeo Solostar	1 unit	80 units	3 times
Toujeo Max Solostar	2 units	160 units	6 times
Tresiba FlexTouch U-100	1 unit	80 units	6 times
Tresiba FlexTouch U-200	2 units	160 units	6 times



## PRE-MIXED INSULIN PEN DOSING

Insulin Products	Unit Increments	Max Units per Dose	Repeat Priming Steps
Humalog Mix 50/50 KwikPen	1 unit	60 units	4 times
Humalog Mix 75/25 KwikPen	1 unit	60 units	4 times
Novolog Mix 70/30 FlexPen	1 unit	60 units	6 times
Humulin 70/30 KwikPen	1 unit	60 units	4 times
Novolin 70/30 FlexPen	1 unit	60 units	6 times

# INSULIN STORAGE GENERAL GUIDELINES



Never store pens with needle attached



Store away from direct heat and sunlight



Do not freeze insulin products

# INSULIN STORAGE

Insulin Product	Open Product Storage
Admelog Vial	Fridge or room temp up to 28 days
Admelog Solostar	Room temp up to 28 days
Humalog Vial	Fridge or room temp up to 28 days
Humalog KwikPen	Room temp up to 28 days
Lyumjev Vial	Fridge or room temp up to 28 days
Lyumjev KwikPen	Room temp up to 28 days
Fiasp Vial and Fiasp FlexTouch	Fridge or room temp up to 28 days
Novolog Vial	Fridge or room temp up to 28 days
Novolog FlexPen	Room temp up to 28 days
Apidra Vial	Fridge or room temp up to 28 days
Apidra SoloStar	Room temp up to 28 days

# INSULIN STORAGE

Insulin Product	Open Product Storage
Humulin R U-100 Vial	Fridge or room temp up to 31 days
Humulin R U-500 Vial	Fridge or room temp up to 40 days
Humulin R U-500 KwikPen	Room temp up to 28 days
Novolin R Vial	Room temp up to 42 days
Novolin R FlexPen	Room temp up to 28 days
Humulin N Vial	Fridge or room temp up to 31 days
Humulin N KwikPen	Room temp up to 14 days
Novolin N Vial	Room temp up to 42 days
Novolin N FlexPen	Room temp up to 28 days

# INSULIN STORAGE

Insulin Product	Open Product Storage
Levemir Vial	Fridge or room temp up to 42 days
Levemir FlexTouch	Room temp up to 42 days
Lantus Vial	Fridge or room temp up to 28 days
Lantus SoloStar	Room temp up to 28 days
Semglee Vial	Fridge or room temp up to 28 days
Semglee Pen	Room temp up to 28 days
Basaglar KwikPen	Room temp up to 28 days
Toujeo/Toujeo Max SoloStar	Room temp up to 56 days
Tresiba Vial	Fridge or room temp up to 56 days
Tresiba FlexTouch	Fridge or room temp up to 56 days

# INSULIN STORAGE

<b>Insulin Product</b>	<b>Open Product Storage</b>
Humalog Mix 50/50 Vial	Fridge or room temp up to 28 days
Humalog Mix 50/50 KwikPen	Room temp up to 10 days
Humalog Mix 75/25 Vial	Fridge or room temp up to 28 days
Humalog Mix 75/25 KwikPen	Room temp up to 10 days
Novolog Mix 70/30 Vial	Fridge or room temp up to 28 days
Novolog Mix 70/30 FlexPen	Room temp up to 14 days
Humulin 70/30 Vial	Fridge or room temp up to 31 days
Humulin 70/30 KwikPen	Room temp up to 10 days
Novolin 70/30 Vial	Room temp up to 42 days
Novolin 70/30 FlexPen	Room temp up to 28 days



# SHARPS DISPOSAL

# ILLINOIS



- Place in sharps container or in a heavy-plastic or metal container
- Secure the lid of household containers with heavy duty tape and write “Do Not Recycle” with permanent marker
- Do not place in recycle bin
- Do not overfill containers (3/4 full)
  
- Drop off collection sites
- Mail back programs



The background of the slide is a blurred, light blue-toned image of a laboratory rack filled with numerous test tubes. The focus is soft, with the tubes in the foreground being slightly more defined than those in the background. The overall aesthetic is clean and clinical.

# INSULIN USE ERRORS

# INSULIN PRESCRIBING ERRORS

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Writing U-500 insulin prescription with U-100 syringes

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Missing Rxs for syringes/pen needles

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Inappropriate syringe size selection

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Rx for wrong insulin product

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Prescribing only prandial or sliding scale insulin without basal

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Wrong dose errors stemming from use of “do not use” abbreviations

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Transcribing errors

PHARMACY TIMES. 10/23/2018.

ISMP. <https://www.ismp.org/alerts/severe-hyperglycemia-patients-incorrectly-using-insulin-pens-home>. ACCESSED 7/28/2021.

JOURNAL OF THE AMERICAN PHARMACISTS ASSOCIATION. 2020; 60: E76-E80.

# INSULIN DISPENSING ERRORS

Missing/inappropriate syringes or pen needles

Dispensing U-100 syringes with U-500 insulin

Incorrect insulin product

Incorrect day supply

- Priming units

# INSULIN ADMINISTRATION ERRORS

Inaccurate injection site selection

Reusing needles

Failure to prime insulin pen

Injecting with capped needle

Relying on pen "clicks" to determine appropriate dose

Improper injection technique

- Site rotation
- Skin pinching
- Twisting to "0" instead of pressing plunger to inject
- Removing pen immediately after injection

Withdrawing U-500 insulin into a U-100 syringe for administration

# INSULIN STORAGE ERRORS



Storing pens with needles on



Storing insulin pens in fridge while in use



Using insulin past discard date



QUESTIONS???

## POST-TEST QUESTION #1

How often should patients prime prefilled insulin pens?

- A. The first time the pen is used
- B. Every time the pen is used
- C. Once a week
- D. Once a month

## POST-TEST QUESTION #2

- KK is a 25 year old male who has been living with T1DM since age 4 years. He currently uses insulin glargine (Lantus) U-100 vial, 38 units QHS and insulin aspart (Novolog FlexPen) U-100, 10 units TID. KK states he needs the "shots" to administer Lantus and has plenty of all other supplies.
- Part I: Which of the following is appropriate to dispense?
  - A. BD Insulin Syringe 31 g 0.5 ml 6 mm
  - B. BD Insulin Syringe 31 g 0.3 ml 4 mm
  - C. Novofine Pen Needle 31 g 4 mm
  - D. Novofine Pen Needle 31 g 6 mm



## POST-TEST QUESTION #2

- KK is a 25 year old male who has been living with T1DM since age 4 years. He currently uses insulin glargine (Lantus) U-100 vial, 38 units QHS and insulin aspart (Novolog FlexPen) U-100, 10 units TID. KK states he needs the "shots" to administer Lantus and has plenty of all other supplies.
- Part 2: Which of the following is the correct day supply to bill KK's insurance for the Lantus 100 unit/mL 10 mL vial?
  - A. 28 days
  - B. 30 days
  - C. 33 days
  - D. 26 days

## POST-TEST QUESTION #4

- Which of the following is an acceptable household container to dispose sharps into?
  - A. Garbage can
  - B. Plastic water bottle
  - C. Glass mason jar
  - D. Plastic detergent bottle



## TAKE HOME POINTS

- There are numerous injectable diabetes medications and medication delivery devices, that all have unique features.
- The pharmacy team can play an integral role in helping people with diabetes achieve success in the use of injectable therapies and devices.
- Support patients, family members, significant others, and caregivers as they consider, initiate and learn how to optimize the use of injectable therapies and devices by
  - ✓ Ensuring the accuracy of prescriptions and orders, order entry, insurance billing, and dispensing of diabetes therapies and devices.
  - ✓ Assessing, identifying, and addressing barriers to optimal use,
  - ✓ Staying up to date on diabetes therapies and technologies to provide ongoing patient training and education.



# RESOURCES

## Insulin injection and delivery

- <https://www.bd.com/resource.aspx?!DX=11020&CMP=PIG>
- <https://www.diabeteseducator.org/practice/practice-tools/diabetes-management-tools/insulin-injection-resources2>
- <https://www.diabeteseducator.org/practice/practice-tools/diabetes-management-tools/ipt-resources>

## Sharps disposal

- <https://safeneedledisposal.org/>
- Illinois: <https://safeneedledisposal.org/states/illinois/>

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# SPEAKER CONTACT INFORMATION

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