

# Diabetes and Insulin Pumps

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# Objectives

- Describe the different types of insulin used in diabetes
- Identify the types of insulin that are compatible with insulin pumps
- Predict supplies that patients on insulin pumps will need

# Overview

- Types of diabetes
- Medications used to treat diabetes
- Types of insulin
- Insulin pump use
  - What are they
  - Why are they used
  - How are they used

# Types of Diabetes

- 3 main types of diabetes:
  - Type 1
  - Type 2
  - Gestational
- Another, lesser known type:
  - Type 1 & 1/2

# Types of Diabetes

- Type 1 diabetes
  - “Juvenile diabetes”
  - 5% of diabetic patients have Type 1
  - Body does not produce insulin
    - Hormone from pancreas
    - Allows body cells to use food as energy
    - Essential for life

# Types of Diabetes

- Type 2 Diabetes
  - 95% of diabetic patients are Type 2
  - Body is resistant to insulin
  - May not produce enough
  - Usually develops in adulthood

# Types of Diabetes

- Gestational diabetes
  - Develops during pregnancy
  - Can go away after baby is born
  - Puts mother at risk for diabetes later

# Complications of Diabetes

- With either type, body cannot pull sugar from blood into cells to use for energy
- Sugar builds up in blood
  - Damages blood vessels
    - Eye
    - Kidney
    - Nerve
    - Heart



# Prevention of complications of diabetes

- Reducing blood sugar to near normal levels reduces risk of damage to vessels
- What is normal?
  - Fasting blood glucose <100mg/dL
  - Blood glucose <140mg/dL
- Different patients will have different blood glucose goals

# Medications

- Type 1:
  - Insulin
    - Replaces body's natural insulin
- Type 2:
  - Oral agents
    - Help body use insulin that it produces
    - Signal pancreas to put out more insulin
    - Stop liver from making glucose
  - Insulin

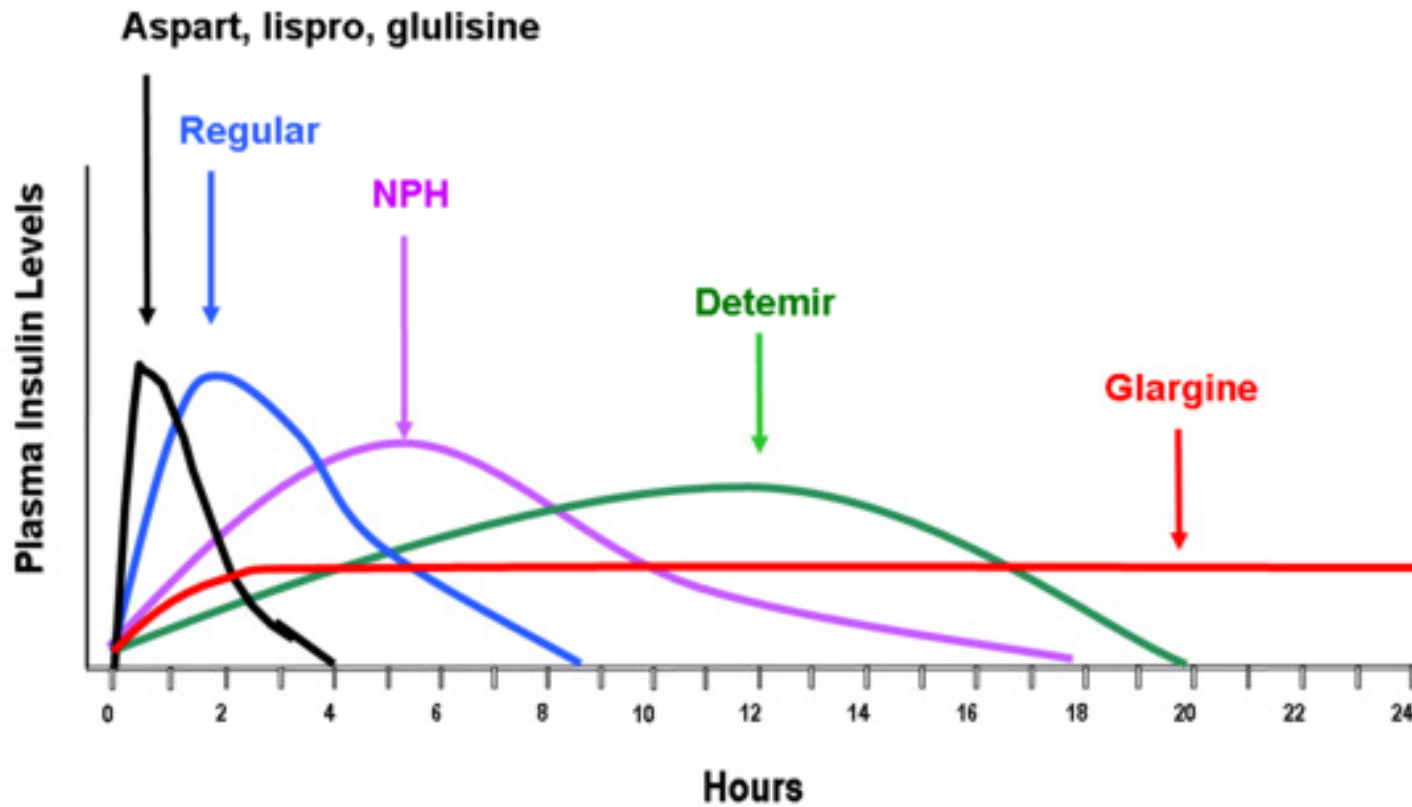
# Types of Insulin

- Many different types
- Differ by
  - How fast they start to work
  - How long they last
- Types
  - Rapid acting
  - Fast acting
  - Intermediate acting
  - Long acting

# Types of Insulin

Type	Generic	Brand
Rapid acting	Aspart	NovoLOG
	Lispro	HumaLOG
	Glulisine	Apidra
Short acting	Regular	Humulin R Novolin R
Intermediate acting	NPH	Humulin N Novolin N *also come in “mixes” with rapid/short acting
Long acting	Detemir	Levemir
	Glargine	Lantus

# Types of Insulin



# QUESTION 1

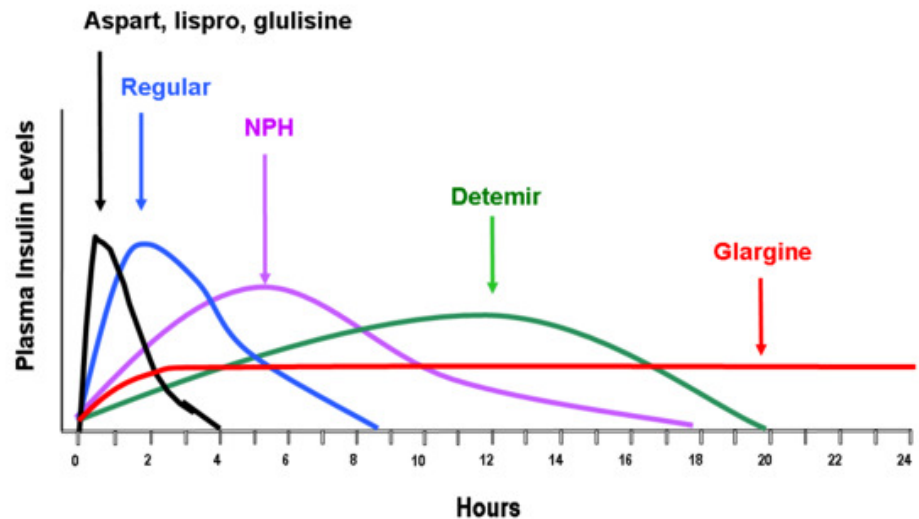
Which of the following types of insulin has the shortest time to onset?

- A. Short acting
- B. Rapid acting
- C. Long acting
- D. Intermediate acting

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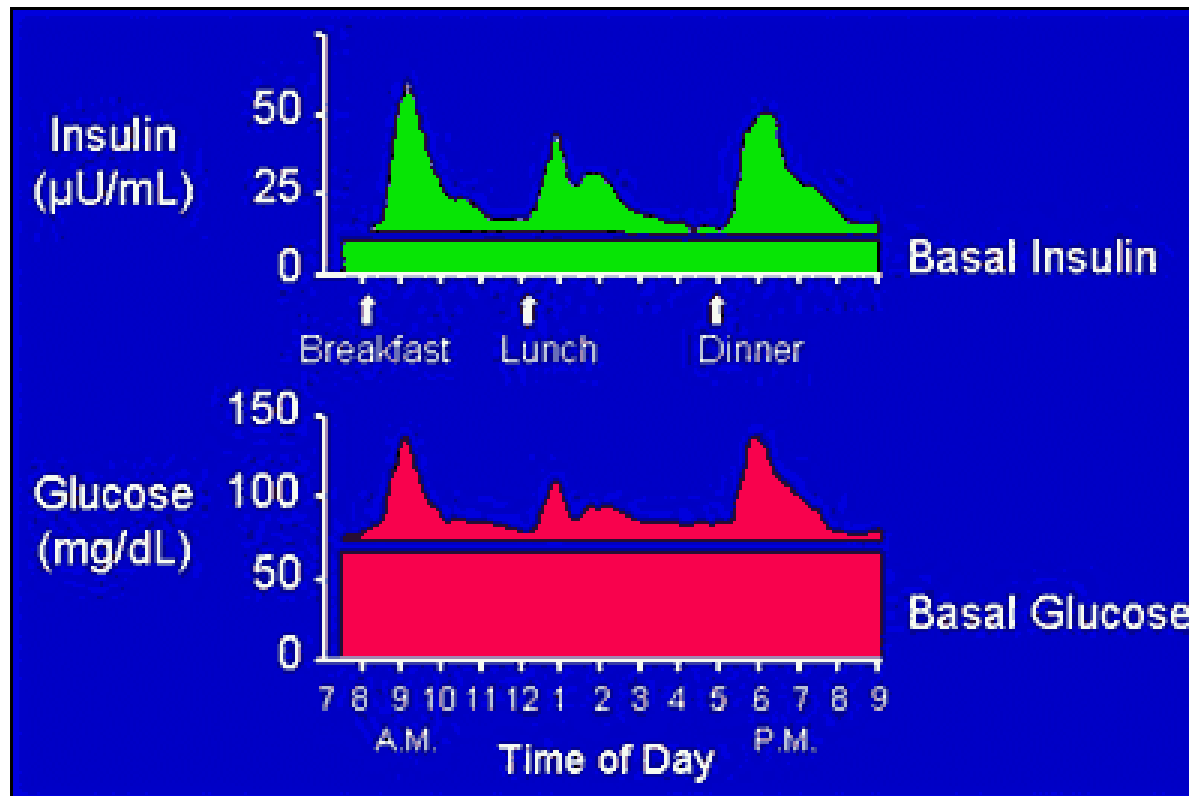


# Insulin Use

- GOAL OF INSULIN: recreate natural insulin supply throughout the day
- Type 2
  - Supplement body's own insulin
  - Body may eventually not make any of it's own
- Type 1
  - Body does not make any
  - 100% of insulin will come from injections

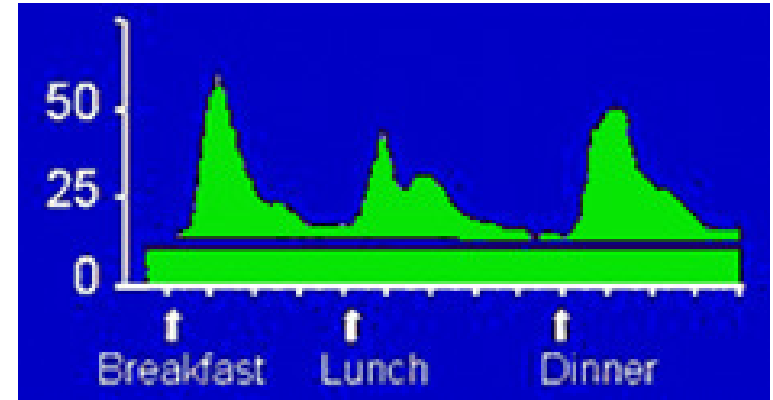
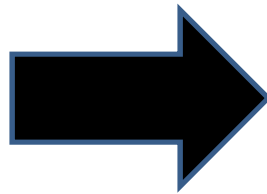
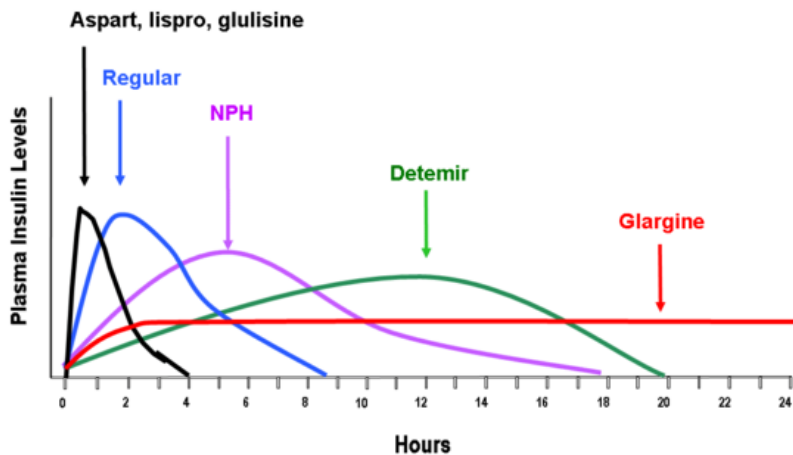


# Natural Insulin Supply



Basal = baseline  
Glucose = sugar

# Insulin Use



**GOAL OF INSULIN:** recreate natural insulin supply

- Accomplish this by using combinations of different insulins
- May require 4 or more injections per day
- May be difficult to find dose that will control blood sugar best

# Insulin Pumps

- Small, pager-sized device
- Administers insulin continuously throughout the day
- Eliminates need for multiple daily injections
- Still have to check blood sugar several times a day



# Insulin Pumps

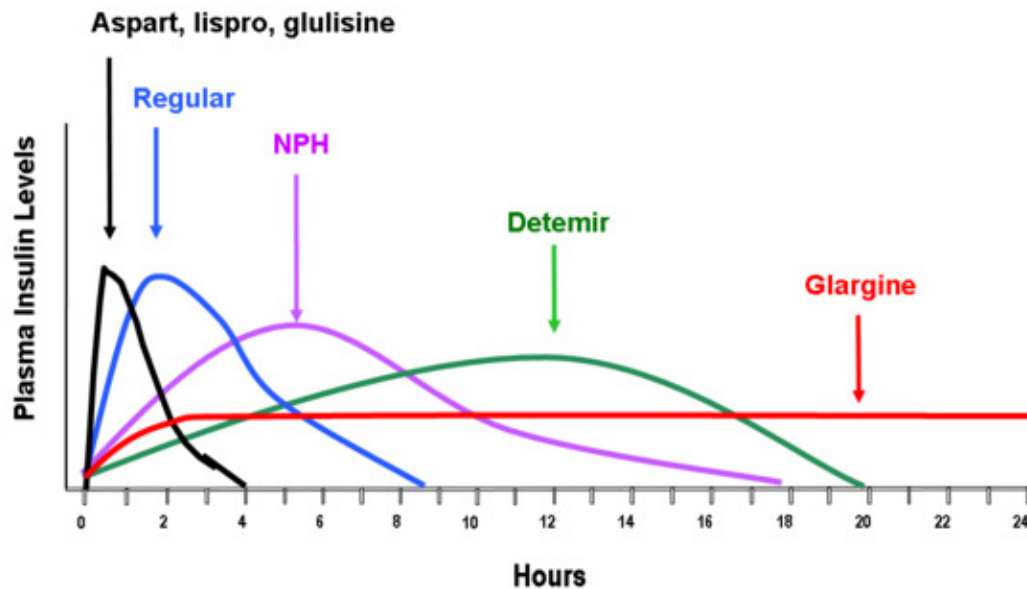
- Basal rate
  - Small amount of insulin infused throughout day
- Bolus doses
  - Larger doses of insulin can be given to match food intake or correct high blood sugars
- These doses vary from person to person
  - Determined by healthcare provider

# Insulin Pumps

- Use RAPID-ACTING insulin

# Insulin Pumps

- Use RAPID-ACTING insulin
  - Quick onset
  - Short duration



# Types of Insulin

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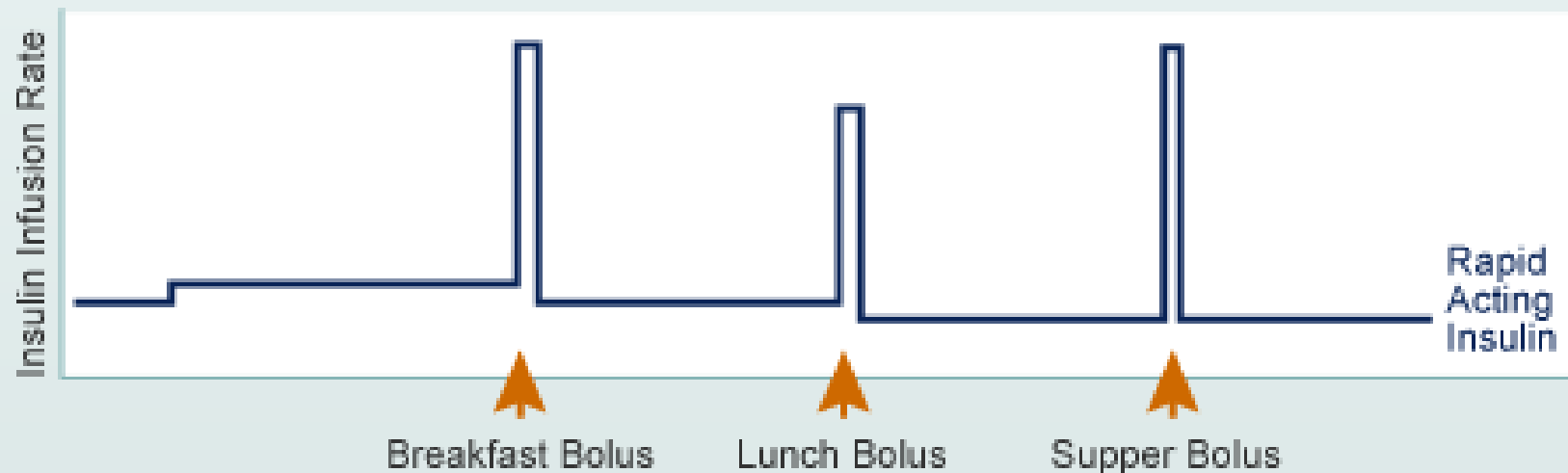
# Insulin Pumps

- Use RAPID-ACTING insulin
  - Quick onset
  - Short duration
- Infused continuously for basal rate
- Infused in boluses for meals or to correct high blood sugars



# Insulin Pumps

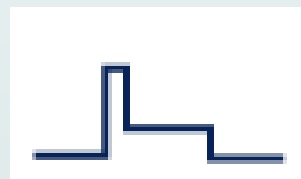
## Insulin Regimen with an Insulin Pump (CSII)



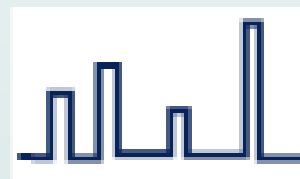
## Examples of different meal bolus profiles with an insulin pump



Standard



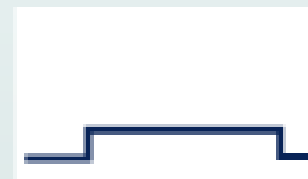
Dual



Multiple



Short Extended



Long Extended

# Insulin Pump

- Small computer that helps to calculate doses and infuse it
  - Basal dose set by doctor
  - Meal time dose depends on carbohydrate intake
    - Patient must count carbohydrates in their meal
  - Correctional doses for high blood sugar

## QUESTION 2

Ms. Anderson is a new insulin pump patient who brings in prescriptions to be filled for her new pump supplies, including one prescription for insulin. It is for Lantus (glargine) “as directed with pump”. You are most concerned about this prescription because:

- A. You are unsure how many units she will use per day and do not know how many vials to give her.
- B. She is not going straight home and will be unable to refrigerate the vial right away.
- C. Glargine is not appropriate for use with insulin pumps.
- D. Ms. Anderson’s previous glargine prescription is not expired and has plenty of refills. This is an unnecessary prescription.

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- C. **Glargine is not appropriate for use with insulin pumps.**

>RAPID ACTING INSULINS<

- A. Ms. Anderson’s previous glargine prescription is not expired and has plenty of refills. This is an unnecessary prescription.

# Insulin Pump Indications

- Failure to achieve glucose goals with injections
- Exercise
- Pregnancy
- Gastroparesis (slowed gastric emptying)
- Changing work/meal schedules
- Pediatric patients

# Carbohydrate Counting

- Carbohydrate counting
  - Requires researching food
  - Requires reading food labels
- Food labels can be confusing
- Requires some mathematical skills

# Carbohydrate Counting

Nutrition Facts	
Serving Size 0.5 cup (67g)	
Servings Per Container 16	
Amount Per Serving	
Calories 150	Calories from Fat 80
% Daily Value *	
Total Fat 9g	14%
Saturated Fat 6g	30%
Trans Fat 0g	
Cholesterol 50mg	17%
Sodium 35mg	1%
Total Carbohydrate 14g	5%
Dietary Fiber 0g	0%
Sugars 13g	
Protein 2g	
Vitamin A	8%
Vitamin C	2%
Calcium	6%
Iron	2%
Vitamin D	0%
* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.	



If I eat a bowl of ice cream, how many carbohydrates have I eaten?

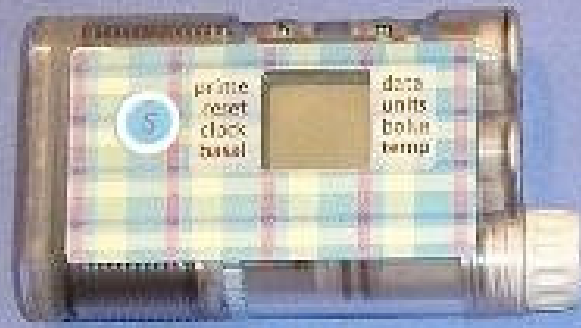
- How much was in the bowl?
- How many carbohydrates were there if I had 1.5 cups of ice cream?

# Pump Candidates

- Type 1 diabetes
  - Or Type 2 with complete deficiency
- Need tighter glucose control
- Motivated and competent
  - Carbohydrate counting
  - Understand insulin adjustment/mathematical equations
- Demonstrate excellent compliance







Insulin Pump

Infusion set tubing

**Cannula:** small tube goes into fat under skin (often in stomach). Held in place with the white adhesive patch.



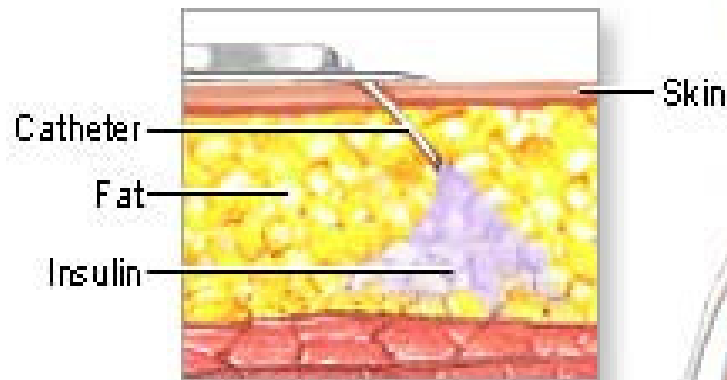
Disconnect here to take pump off.



Teflon cannula

Adhesive that sticks to skin

Tubing to pump



Dosage instructions are entered into the pump's small computer and the appropriate amount of insulin is then injected into the body in a calculated, controlled manner

Insulin pump

A photograph of a person's neck and shoulder. An insulin pump is attached to the neck, connected to a tube that leads to a sensor on the shoulder. The pump has a small screen and several buttons. A label 'Insulin pump' points to the device.

# Insulin Reservoir



# Supplies

- Pump
- Insulin
- Infusion sets – changed every 3 days
- Cartridges/reservoirs
- Patients will still need needles/syringes
  - To fill the reservoir in the pump
  - In case their pump fails and they have to give injections
  - Glucose testing supplies

# Cost

- Pumps can cost more than \$6,000-\$7,000
- Infusion sets cost \$10-20/set
  - Changing every 3 days
- May be covered by insurance

# Inpatient Pump Patients

- Pump patients in the hospital
  - Some hospitals allow patients to stay on their pumps in the hospital
  - Provide own supplies and manage it themselves
- Technicians can be involved with creating a policy to allow patients to keep continue to use their pumps as inpatients



# QUESTION 3

Ms. Anderson also turns in a prescription for some syringes. She tells you she does not need the syringes since she is now using a pump and asks you to discard the prescription. What should you tell her?

- A. You are right. You will not use syringes anymore since the pump will be supplying all of your insulin needs. I will discard the prescription.
- B. You will still need syringes to give yourself meal time insulin injections in addition to your pump. I will fill these.
- C. You will still need syringes to give yourself basal insulin injections in addition to your pump. I will fill these.
- D. You might want to have some syringes on hand in case your pump malfunctions and you need an alternate way to inject your insulin. I will fill these just in case you need them.

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# References

- “Insulin Pump Therapy”. Pharmacist’s Letter. December 2010.
- “Technician Training Tutorial: Dispensing Insulin”. Pharmacy Technician’s Letter. 2008.
- “Insulin Pump Therapy: Guidelines for Successful Outcomes”. American Association of Diabetes Educators. 2008 Consensus Summit.
- [www.endotext.org](http://www.endotext.org)