

# Diabetes: Understanding the Disease State

Noah Palmieri, PharmD., RPh

Adjunct Faculty, MCPHS University School of Pharmacy  
Boston, MA



**AAPT 37<sup>th</sup> ANNUAL  
NATIONAL CONVENTION  
August 30-31, 2019  
Rosen Shingle Creek • Orlando, FL**

# Disclosures

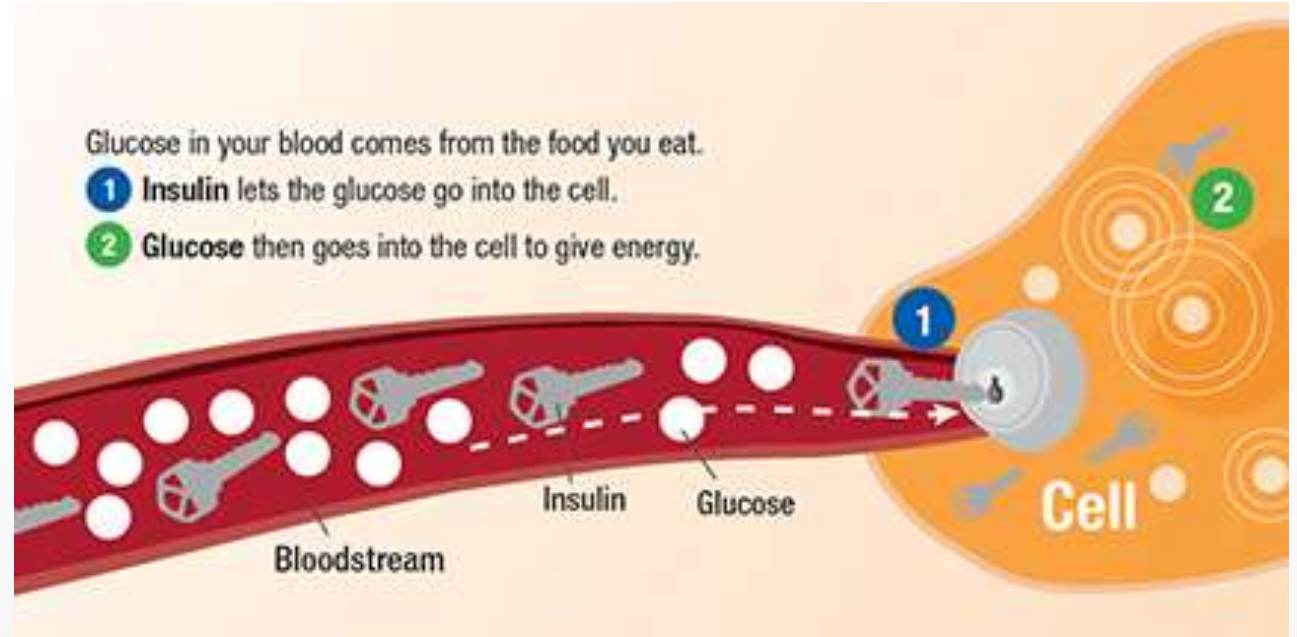
- No COI to disclose

# Learning Objectives

- Provide a general overview of diabetes mellitus (Type 1, Type 2), risks, and associated complications
- Describe patient-related barriers to initiation of insulin therapy and educational strategies to address these issues
- Provide an overview of insulin delivery devices, including pen needles, syringes, auto injectors, and pump based therapy
- Review best practices for insulin injection technique

# What Is Diabetes?

- Metabolic Disorder
- Elevated blood glucose (“High sugars”)
  - Acute complications
  - Chronic complications
    - General and disease specific



# Normal Physiology

- Liver and pancreas engage in a metabolic “dance”
- Sugar elevates in two main ways
  1. Eating
  2. Release of glycogen stores in liver in presence of glucagon
- Pancreas secretes two important hormones
  - Insulin
  - Glucagon
- Two organs work together to keep blood sugar at appropriate levels
- \*Glucose helps to power cells but will only enter cells if insulin is present
- Primary power source of the brain is glucose



# Physiology In Diabetes

- Liver and Pancreas lose their ability to work together
- Pancreas may secrete less or no insulin
- Liver and skeletal muscle may not respond to insulin as well as they should
- Result:
  - Glucose (sugar) is trapped within the bloodstream with no way to be stored
  - Consequences
    - Dehydration, hyperglycemia, and other serious chronic complications

# Types of Diabetes

- Type 1
  - Destruction of beta cells leads to **inability to produce insulin**
  - “Insulin dependent diabetes”
  - About 5% of cases
- Type 2
  - **Insulin resistance** – body doesn’t respond to insulin as well as it should
  - Abnormal insulin production
  - 95% of cases of diabetes
- Gestational – FYI but will not be covered today

# Symptoms

- Type 1
  - Increased urination, thirst, and hunger
  - Peak incidence from 10-15 years of age
  - Weight loss
- Type 2
  - May not show symptoms for years
  - First signs of symptoms/complications often appear years after establishment of disease



# Prevalence in US

- As of 2016-2017: 9.7% of US Population
  - ~30 million Americans
- This number is expected to rise
  - ~90 million with pre-diabetes
    - Increased risk of T2DM and heart disease



- Total number of Americans with diabetes and prediabetes is more than populations of Spain, Italy, and Belgium.. **Combined!**



# The Diabetes Landscape: United States

Prevalence

**30**

**million**

Americans  
have

**DIABETES**



Diagnosed

**23**

**million**

are

**DIAGNOSED**



**7**

million are  
**UNDIAGNOSED**

Treatment

**19**

**million**

are

**TREATED**



**4**

million are  
**UNTREATED**



**8**

**million are**

**SUCCESSFULLY  
TREATED**

**11**

million are  
**UNSUCCESSFULLY  
TREATED**



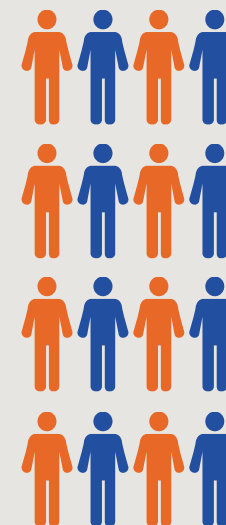
Diabetes

**22**

**million**

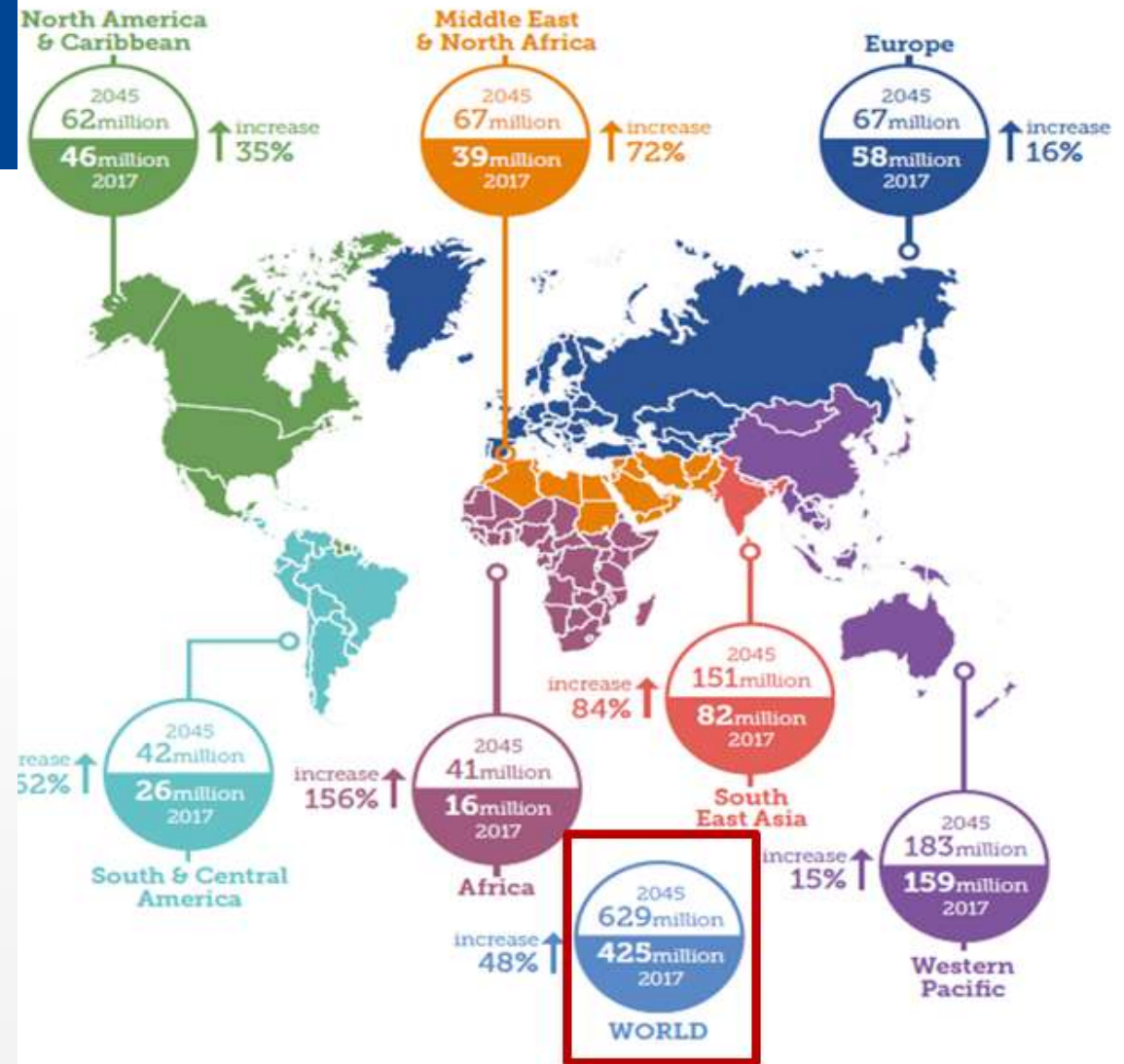
have

**UNCONTROLLED  
DIABETES**



# Worldwide

Number of people with diabetes worldwide and per region in 2017 and 2045 (20-79 years)

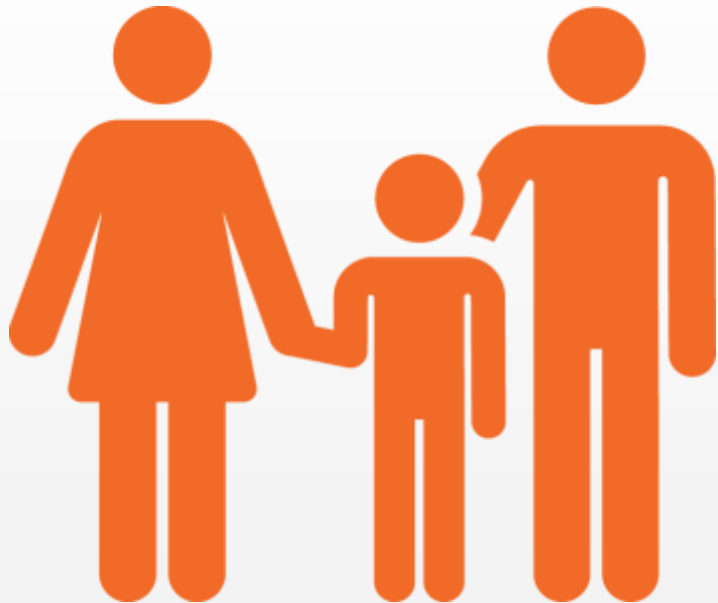


IDF Diabetes Atlas 8th Edition 2017

# Risk factors<sup>1</sup>

## Type 1 diabetes

- Family history



## Type 2 diabetes



- Weight



- Inactivity



- Family history



- Race

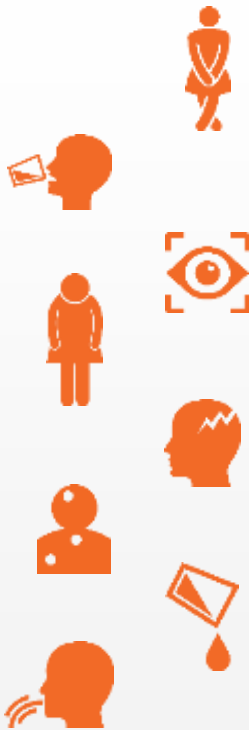


- Age

# Hyperglycemia—*High blood sugar*

Blood glucose  $\geq 200$  mg/dL, Common acute complication

## Signs and symptoms<sup>1</sup>



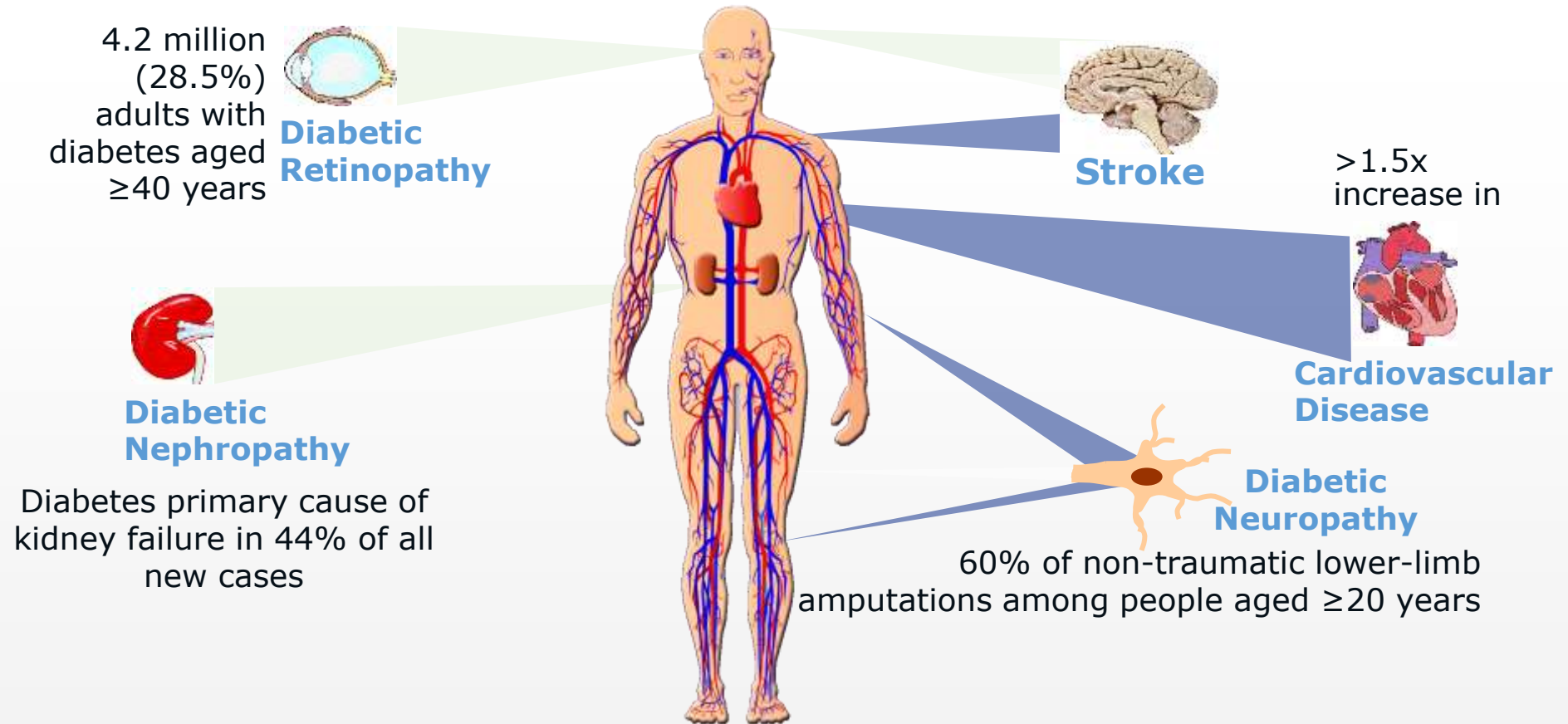
- Frequent urination (urinary incontinence)
- Increased thirst
- Blurred vision
- Fatigue
- Headache
- Sores that are not healing
- Dry mouth
- Nausea and vomiting

## If left untreated hyperglycemia can cause:<sup>1</sup>

- Neuropathy
- Retinopathy
- Nephropathy
- Stroke
- Diabetic ketoacidosis (DKA)

1. Hyperglycemia in diabetes. Mayo Clinic. Accessed June 19, 2019, at <https://www.mayoclinic.org/diseases-conditions/hyperglycemia/symptoms-causes/syc-20373631>

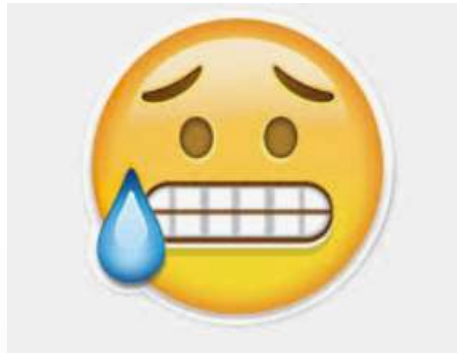
# Chronic Complications



# Section 1 Key Points

- Sugars are constantly controlled by pancreas and liver in a “dance”
- Diabetes has two main types
  - Type 1: Needs insulin to survive
  - Type 2: Body is resistant to action of its own insulin
- Both types = Elevated blood sugars
- Elevated blood sugars lead to acute and chronic medical conditions

# Patient Barriers to Insulin Therapy



- [illegible]



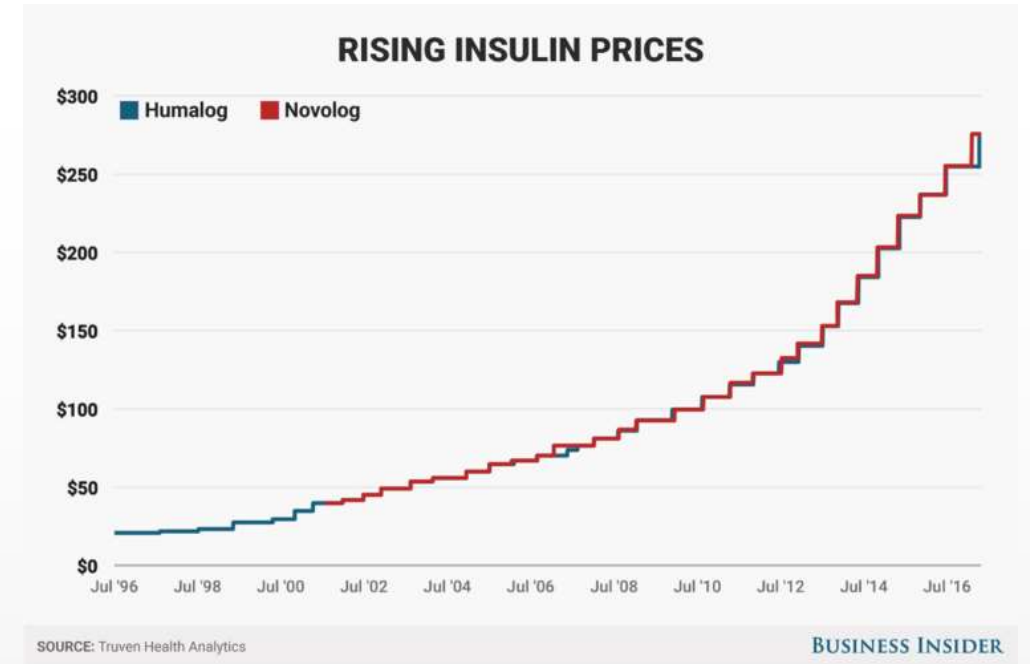
# Psychological

- Patients may need to inject 1-4+ times daily
- Needles have gotten more comfortable over time
  - Still tough to convince patients to inject
- Some view as punishment
  - “Get your sugars down, or else!”
- Insulin tends to increase weight slightly



# Financial

- Insulin is quite expensive
- High variation when it comes to pricing based on insurance plans vs cash
- Monitoring blood sugar can be expensive as well
  - Meters, strips, lancets



1. <https://www.businessinsider.com/insulin-prices-increased-in-2017-2017-5>

# Misconceptions

- Insulin was invented 98 years ago
  - Has come a long way with new formulations and purity
  - Insulin of today is not your “grandfather’s insulin”
- Some patients believe that insulin can have poisonous effects
  - Picture someone who’s been on insulin for years and has a significant CV event
    - The primary cause of their CV event was having diabetes for a number of years, not introducing insulin to their treatment

# The Importance of Patient Education

- If a patient brings up a prescription for insulin and mentions it's their first time getting the drug
  - Show empathy towards the patient
    - This is a big step in therapy for them (either escalation or diagnosis)
    - Insulin is complicated, expect questions about it
  - Be forthcoming with informative resources located within the pharmacy
    - More to come on these later
  - Utilize the pharmacist to help with counseling and technical questions
  - Look out for a prescription for an injection device
    - Insulin in a vial must have a syringe prescription
    - Insulin in a pen must have a pen needle prescription

# Section 2 Key Points

- There are a number of reasons why patients are averse to Insulin
  - Psychological
  - \$\$\$
  - Misinformation
- Showing genuine empathy towards patients will help them in their transition towards insulin
  - This is a key area where Pharmacy Technicians can help
  - Patients often see Pharmacy Technicians at the start and end of their trip to the pharmacy

# Insulin Delivery Options



# Insulin facts

- Must be refrigerated for long term storage
  - \*Cannot be frozen
- Insulin can be stored outside of the fridge for a short period of time while patients are using it
  - Varies by insulin, but insulin at pharmacies should always be in fridge
- Has variable appearance and concentrations
  - Insulin is generally clear, but formulations with “mix” or “NPH/Isophane” in their name are cloudy. This is normal
  - Most are U-100, U-200, U-300 or U-500
- Never attempt to mix insulin in the pharmacy

# Insulin Vials & Syringes

- Glass vial, requires a syringe to remove insulin
- Syringes have variable barrel sizes and needle lengths
  - Barrel size = syringe capacity
- For U-100 Insulin
  - $3/10\text{ml} = 30$  units
  - $1/2\text{ml} = 50$  units
  - $1\text{ ml} = 100$  units
- **3** important items when filling Rx for syringe
  - Needle dimension, barrel size, correct unit scale/concentration



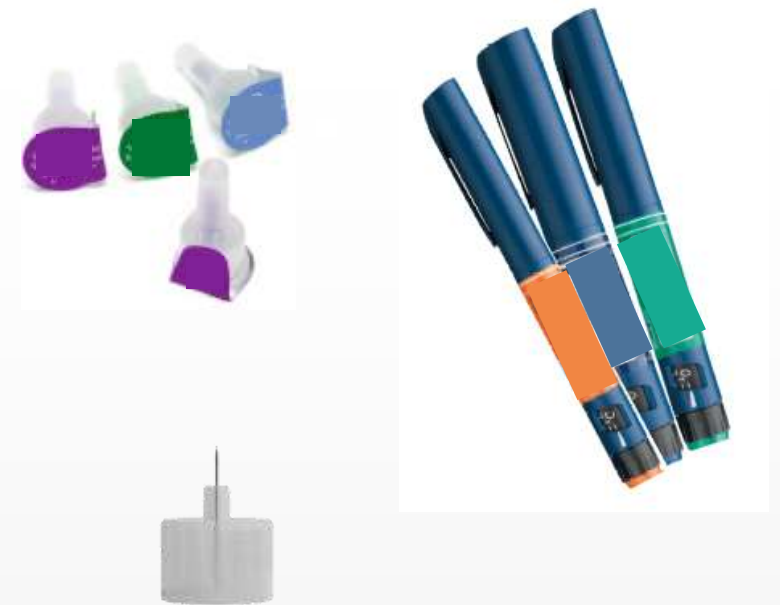


# Syringes

- Variety of lengths available
  - 6mm, 8mm, 12.7mm are most common
- **6mm should be the syringe length of choice for all patients<sup>1</sup>**
  - Some may prefer longer needles due to familiarity
- Syringes should be used one time, and discarded safely in a sharps container
  - Needle re-use discussed later on

# Pen Injectors and Pen Needles

- Pens allow for easier injection experience
  - Insulin dose is selected by turning a counter at the end of the pen rather than being drawn up
- Pen needles *must* be used with insulin pens to deliver insulin
- Typical lengths: 4mm – 12.7mm
- **4mm and 5mm pen needle should be the first choice for all patients based on recommendations<sup>1</sup>**
  - Talk to your pharmacist about this!
- Proper labeling in hospitals/LTC settings is important – pens cannot be shared
- Length is main area to worry about when filling pen needle Rx



# Insulin Pumps, Auto, and Jet injectors (FYI)

- Insulin may be delivered via automated pumps for some patients
- FYI – most of what you'll see on a daily basis will be insulin pens and vials
- If a patient presents a prescription for a pump, check with the pharmacist to see if it can be filled at your pharmacy
- Auto injectors use syringes to automate injection, jet injectors use high pressure to push a small stream of insulin through the skin without a needle



# Risks Associated with Insulin Therapy

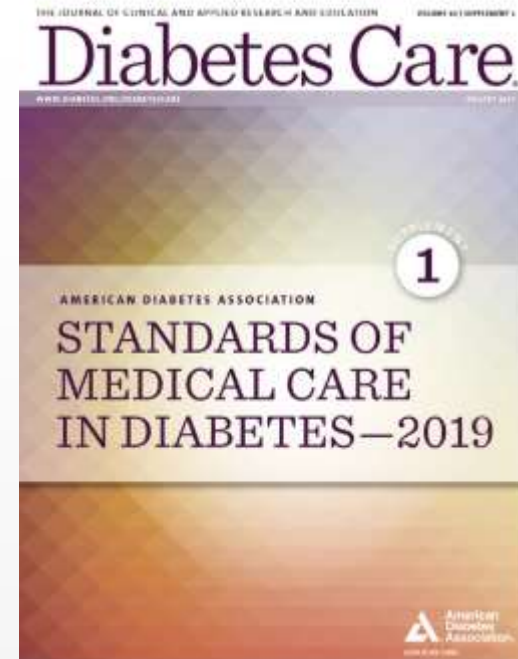
- Insulin reduces blood sugar, but going too low is dangerous
- Below a blood sugar of 70mg/dl, patients may start to feel dizzy, agitated, and tired
  - This is called hypoglycemia – the remedy is to consume fast acting carbohydrates
    - Juice, glucose gel/tablets
  - Cases of severe hypoglycemia can be extremely serious
- Could happen due to over dosage of insulin, the patient not eating enough at a meal, or an intramuscular injection



# Section 3 key points

- Insulin can be delivered in a variety of formats
  - Pen injectors and vial + syringe are the most commonly seen
- Insulin should be stored in the refrigerator at all times in the pharmacy
- Main adverse effect of insulin is hypoglycemia (low blood sugar)
  - Serious condition
  - Patients should be encouraged to buy glucose gel or tablets at the pharmacy as a safety net

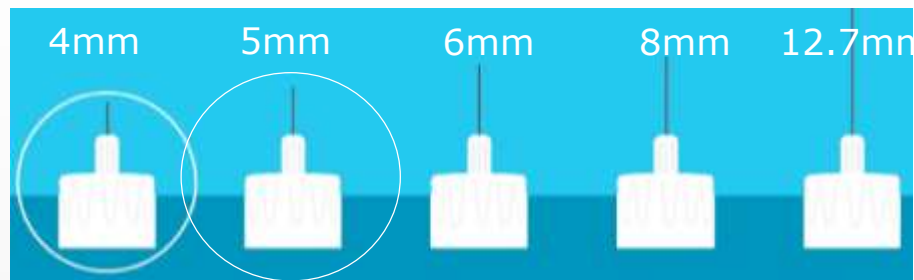
# Overview of Injection Technique and Selected Recommendations



# A Major Shift to Shortest Needle Lengths

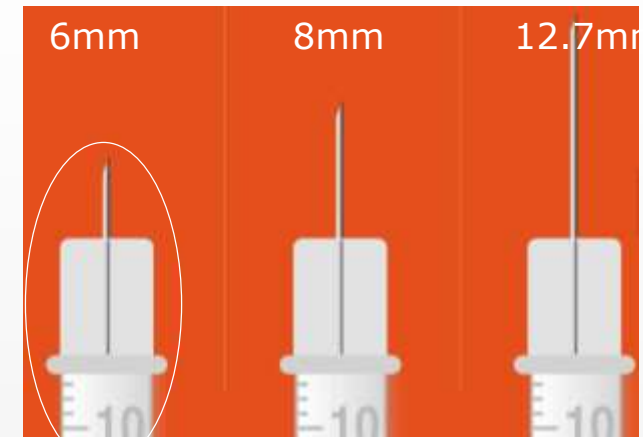


## Pen Needles



- **4mm & 5mm pen needles** as initial therapy are the safest pen needle for adults and children regardless of age, sex, ethnicity, or BMI.

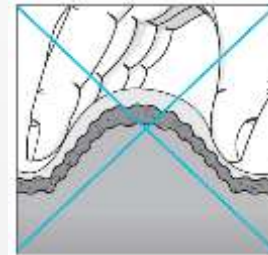
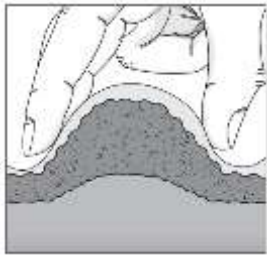
## Insulin Syringes



- **6mm insulin syringes** are recommended as the safest syringe needle for patients.

# To Pinch or Not to Pinch?

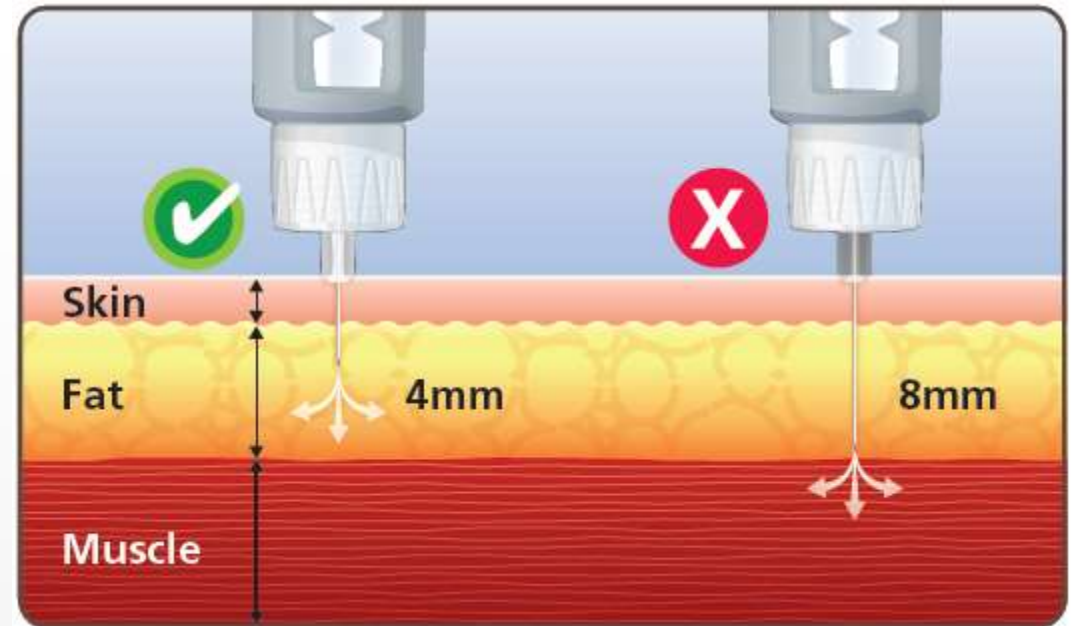
- Injections performed with a  $\geq 6$  mm needle should utilize a pinch up
- A correct pinch-up is made by lifting the skin with the thumb and index finger
- If the skin is lifted using the whole hand, muscle may be lifted as well as subcutaneous tissue, which can lead to intramuscular injections





# Needle Length and Pinch Up: Why do They Matter?

- Insulin injections into the muscle can change how it works in the body<sup>1</sup>
- Can result in poor glucose control (excessive high and lows) and unexplained hypoglycemia<sup>1</sup>



1. Frid AH, Kreugel G, Grassi G, et al. New insulin delivery recommendations. *Mayo Clin Proc.* 2016;91(9):1231–1255.

# Insulin Injection Technique – Best Practices

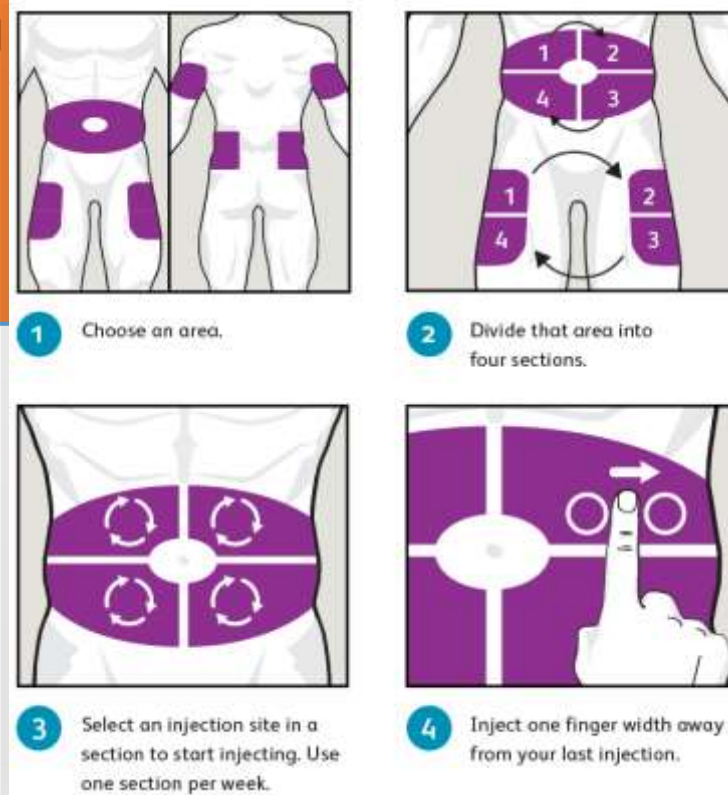
## ■ Site Rotation

■ Injection site: warm, rubbed, or exercised

■ Lipohypertrophy

## Practice proper site rotation<sup>1</sup>

- A new site should be used for each injection
- Injections should be spaced at least 1 cm from previous injection sites
- Injection sites should be disinfected before injection

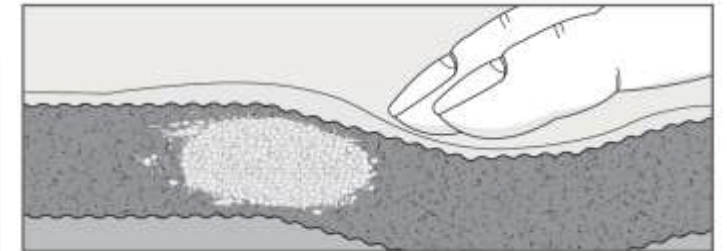


# Insulin Injection Technique – Best Practices

- Site Rotation
- Injection site: warm, rubbed, or exercised
- Lipohypertrophy

## What is lipohypertrophy?

Lipohypertrophy (or **lipo**) is a thickened, rubbery swelling under the skin that can happen to people where they inject insulin. These lumps may be soft or firm. Because it is under the skin, you may not always be able to see lipo—you may have to press on your skin to feel it.<sup>1</sup>



## What causes lipo?

A large international survey of people with diabetes who inject insulin found that there are three independent risk factors that make people more likely to develop lipo:<sup>2</sup>

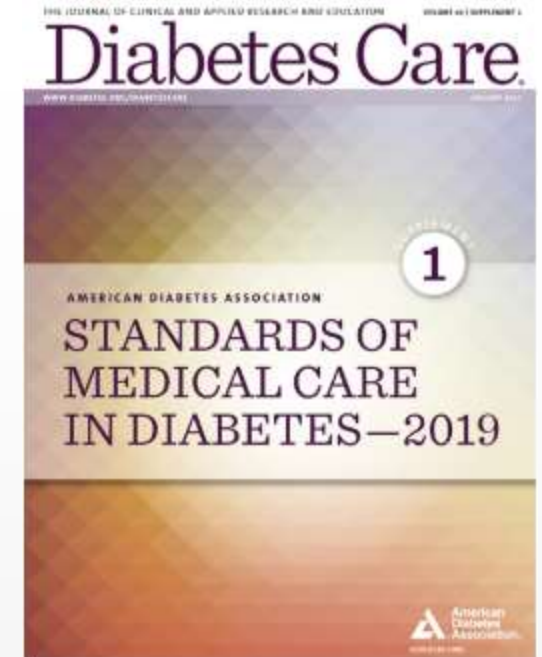
1. Using insulin for a longer period of time
2. Not rotating injection sites correctly
3. Using a needle more than once

1. Blanco M et. al. "Prevalence and risk factors of lipohypertrophy in insulin-injecting patients with diabetes" Diabetes & Metabolism. 2013;39(5):445-53.

2. Frid A, Hirsch L, Menchior A, Morel D, Strauss K. Worldwide injection technique questionnaire study: injecting complications and the role of the professional. Mayo Clin Proc. 2016;91(9):1224-1230.

# ADA Standards – 2019

- ADA standards of care mention injection technique (IT) evaluation and education as important part of effective diabetes care
- Start the conversation with patients!
  - Provide them with IT educational materials
  - Refer them to the pharmacist for hands on training with devices and miscellaneous questions



# Ways To Make An Impact

- Retail setting
  - Always make sure that insulin prescriptions are accompanied by device prescriptions
    - If a patient drops off an insulin Rx, ask if they have the proper injection supplies at home (pen needle or syringes)
  - Cough syrups and other liquids are typically high in sugar content
    - If a patient is ringing out a cough syrup with insulin or needles, remind them that the syrup likely has sugar
  - Recommend patient to purchase glucose gel or tablets to keep on hand in case of emergency
- Make the offer to have the pharmacist counsel during check-out
  - Avoid saying “sign here”

# Ways To Make An Impact

- Hospital/Long Term Care setting
  - Ensure that nurses and floor staff are storing insulin the correct way (in the fridge!)
  - Insulin pens and vials should only be used on one patient
    - Label the body of insulin pens, not the lid (lids can be mixed up)
  - Ensure that pharmacy fridges are functioning at the right temperature
    - 36-46° F

# Wrap Up

- Patients rely on pharmacy services more now than ever before
  - On average, patients visit their doctor 4 times per year
  - Any guesses for how often patients visit their pharmacy?
- As a Pharmacy Technician, you are oftentimes one of the first team members to interact with a patient
  - This is a very important place to be!
  - You have the ability to improve the experience and care that patients receive!

35

