



Insulin Basics

- Anabolic hormone involved in metabolism
- Following carbohydrate ingestion insulin release is stimulated
 - Suppresses hepatic glucose production
 - Stimulates peripheral glucose uptake
- Commercially-available insulins have been synthetically modified for desirable properties

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Current Insulin Products and Pens

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Rapid-Acting Insulin Analogs

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Tibaldi, JM, JAMA 2014

History of Insulin Therapy

1921: Isolation of insulin, Bering & Medco
1922: Hagedorn procaine-retarded insulin NPH
1923: Recombinant human insulin
1924: Basal insulin analogues
1925: Animal insulin preparations
1940: Lente® insulin series
1944: Rapid-acting insulin analogues

1973: introduction of U-100 insulin; previously available as U-40 or U-80
1994: approval of U-500 insulin

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Tibaldi, JM, JAMA 2014
Moss et al. JAMA 1977

Basal Insulin Analogs

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Tibaldi, JM, JAMA 2014

Principles for Insulin Dosing

- Individualize based on patient response
- Goal: mimic normal insulin secretion
 - Basal insulin replacement
 - Target fasting blood glucose goals
 - Bolus/prandial or mealtime
 - Targets nutritional ingestion
 - Correction/supplemental:
 - Added coverage to correct hyperglycemia

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Comparisons of Insulin

	Insulin Preparations	Onset of Action	Peak	Duration of Action
Prandial	Lispro, Aspart, Glulisine	5-15 min	30-90 min	3-5 hrs
	Regular	30-60 min	2-3 hrs	5-8 hrs
	Regular (inhaled)	15-30 min	1 hr	3 hrs
Mixed	Regular U-500 (concentrated)	≤ 30 min	2-3 hrs	12-24 hrs
Basal	NPH	2-4 hrs	4-10 hrs	10-16 hrs
	Glargine (U-100)	2-4 hrs	"Peakless"	20-24 hrs
	Glargine (U-300)	6 hrs	"Peakless"	>24 hrs
	Detemir	3-4 hrs	6-8 hrs	5.7-23.2 hrs
	Degludec	30-90 min	"Peakless"	42 hrs

Normal Physiological Response

- Phase 1 (10 minutes prior to glucose load)
 - Suppression of hepatic glycogenolysis and glyconeogenesis
 - Loss – early detection of type 1 diabetes
- Phase 2 (20 minutes after glucose load)
 - Peaks 1-2 hours
 - Glucose not uptaken by liver → peripheral tissues

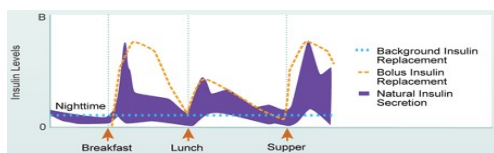
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Insulin to Patients

- Injection anxiety
- Sense of loss of control
- Belief disease has worsened
- Sense of failure
- Fear of weight gain
- Fear of hypoglycemia
- Perception insulin is not effective
- Other concerns (work, family and friends)
- Complexity of the regimen

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Insulin Therapy



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Jacobs et al DM Care 1997

Insulin Pens

- **Injection anxiety**
- **Sense of loss of control**
- Belief disease has worsened
- Sense of failure
- Fear of weight gain
- Fear of hypoglycemia
- Perception insulin is not effective
- **Other concerns (work, family and friends)**
- **Complexity of the regimen**

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J Am Osteopath Assoc 2013;113:56-616

Insulin Pens

- KwikPen
 - Basaglar, Humalog, Humulin products
- SoloStar
 - Apidra, Lantus, Toujeo
- FlexTouch
 - Levemir, Tresiba
- FlexPen
 - Novolog

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Pharmacist's Letter/Prescriber's Letter, March 2015.

KwikPen

Agents	Room Temp Stability	Color	Dosage Range
Lispro (Humalog)	28 days	Burgundy Black (U-200)	1 - 60 units
NPH/Lispro (Humalog Mix 75/25)	10 days	Yellow	
NPH/Lispro (Humalog Mix 50/50)	10 days	Red	
NPH (Humulin N)	14 days	Green	
NPH/Regular (Humulin 70/30)	10 days	Orange	1 - 300 units (5 unit increment)
Regular U-500 (Humulin R U-500)	28 days	Teal	

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Insulin Pen Anatomy

- KwikPen
- SoloStar
- FlexTouch
- FlexPen

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Solostar

Agents	Room Temp Stability	Color	Dosage Range
Glulisine (Apidra)	28 days	Blue	1 - 80 units
Glargine U-100 (Lantus)	28 days	Purple	
Glargine U-300 (Toujeo)	42 days	Green	

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Insulin Pen Considerations

- Appearance/Medication Prescribed
- Dosage Range
- Stability at Room Temperature
- Needle compatibility
- Packaged

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FlexTouch

Agents	Room Temp Stability	Color	Dosage Range
Detemir (Levemir)	42 days	Green	1 - 80 units
Degludec (Tresiba)	56 days	Lime green	1 – 80 units (U-100) (1 unit increments)
		Olive green	1 – 160 units (U-200) (2 unit increments)

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FlexPen

Agents	Room Temp Stability	Color	Dosage Range
Aspart (Novolog)	28 days	Orange	1 - 60 units
NPH/Aspart (Novolog Mix 70/30)	14 days	Blue	

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Patient Assistance

Information	Comments
www.needymeds.org	<ul style="list-style-type: none"> Lists meds available through patient assistance programs (PAPs) List of manufacturers with PAPs Information on state and federal assistance programs
www.rxassist.org	<ul style="list-style-type: none"> PAPs through company, brand, and generic name Descriptions on various options for Rx assistance
www.pparx.org	<ul style="list-style-type: none"> Search for programs by manufacturer Information about Medicaid, Medicare, and co-pay assistance programs
www.rxhope.com	<ul style="list-style-type: none"> Manufacturer or drug search Advanced search available to help determine eligibility for state- and company-sponsored PAPs.
www.benefitscheckup.org	<ul style="list-style-type: none"> Report of public and private programs available to help reduce costs of Rx drugs. Online application for Medicare Rx Extra Help (low income subsidy).
Drug Manufacturers	<ul style="list-style-type: none"> Medication websites
Insurance Provider	<ul style="list-style-type: none"> Formularies can change daily Empower patients to research options

Insulin Pen Sizes

Drug	Units Per Pen	Pens Per Box	Units Per Box
Degludec	600	3	1800
Levemir	300	5	1500
Glargine U-300	450	3	1350
Glargine U-100	300	5	1500
Lispro U-200	600	2	1200
Lispro U-100	300	5	1500
Regular U-500	Vial – 20 mL vial contains 10,000 units Pen – will contain 3 mL or 1,500 units		
Regular U-100*	Vial only – 3 mL vial contains 300 units 10 mL vial contains 1,000 units		

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Summary

- “Traditional” insulins will still have a place in therapy and education
- Insulin pens have increased in use
- Educational considerations for various pens

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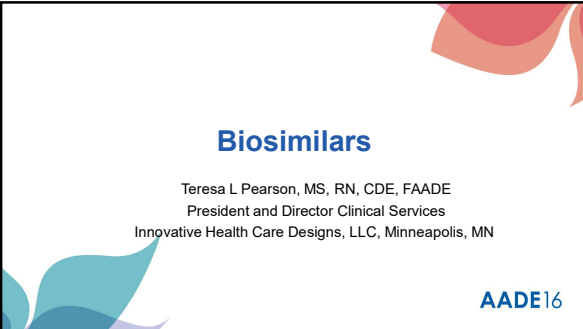
Insulin	Cost per pack	Maximum units per injection	Manufacturer	Manufacturer Patient assistance
Degludec (U-200) (Tresiba®)	\$533	160	Novo Nordisk	\$15 per month
Detemir (U-100) (Levemir®)	\$373	80	Novo Nordisk	\$25 per month
Glargine (U-300) (Toujeo®)	\$336	80	Sanofi	\$15 per month
Glargine (U-100) (Lantus®)	\$373	80	Sanofi	\$25 per month
Lispro U-200	\$344	60	Eli Lilly	\$25 per month
Lispro U-100	\$392	60	Eli Lilly	N/A
Regular U-500	N/A	300	Eli Lilly	\$25 per month
Regular U-100	N/A	100	Eli Lilly	N/A

Pharmacist's Letter/Prescriber's Letter, March 2015.

Concentrated Insulin

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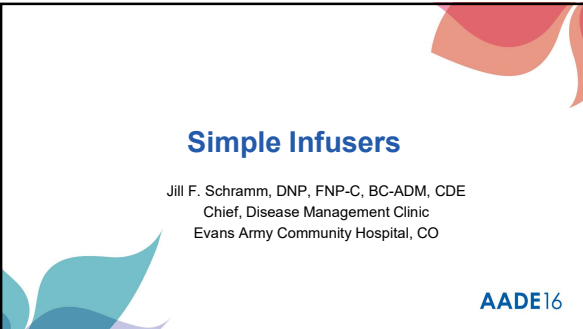
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Biosimilars

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Simple Infusers

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