Updates in Diabetes Management

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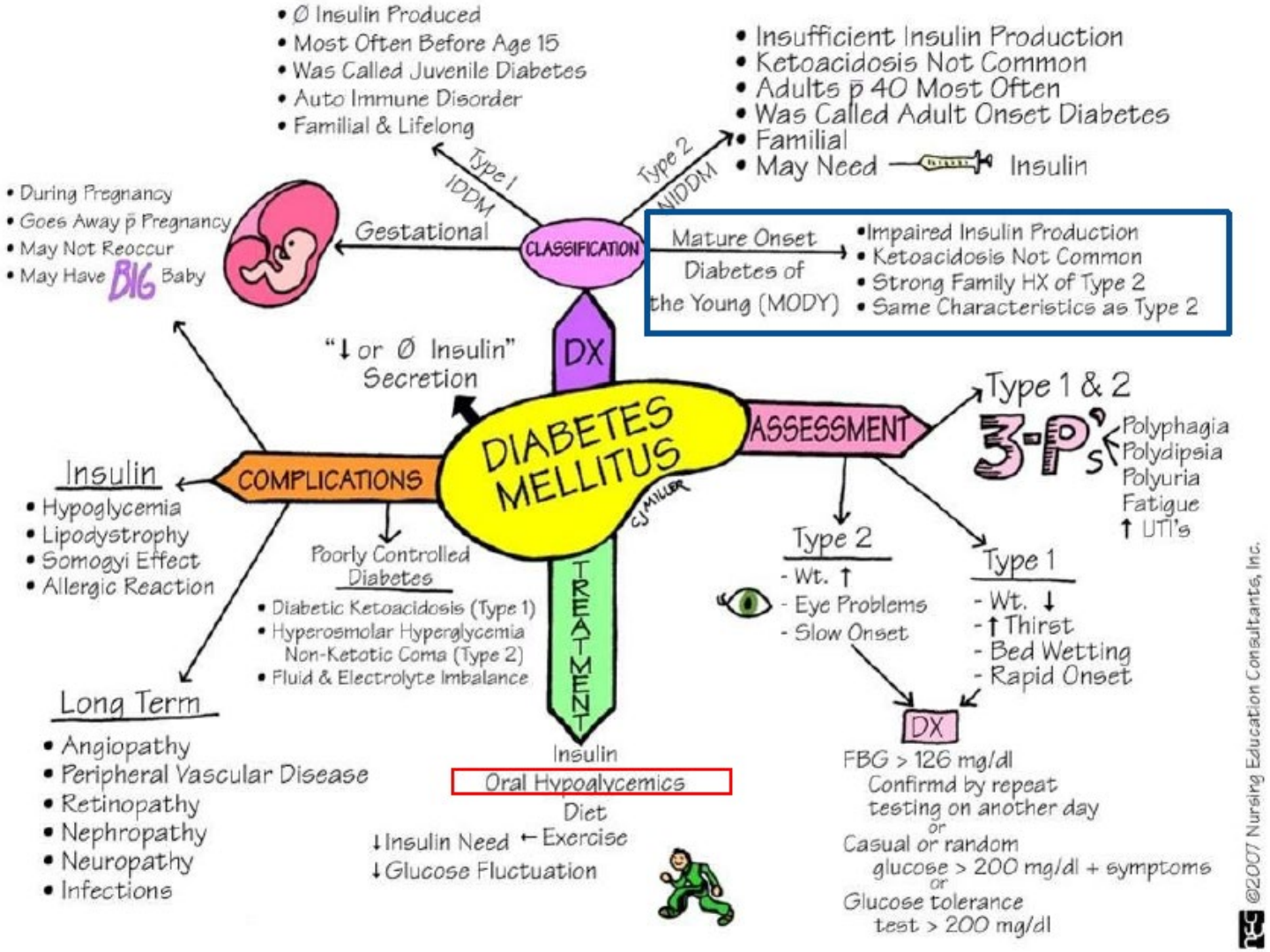
January 30, 2020

- No conflicts of interest or disclosures

Objectives

- Define current standards for the evaluation of diabetes
- Review new technologies in diabetes management


DIABETES MELLITUS
CLASSIFICATION
Type 1 IDDM
• Ø Insulin Produced
• Most Often Before Age 15
• Was Called Juvenile Diabetes
• Auto Immune Disorder
• Familial & Lifelong
Type 2 NIDDM
• Insufficient Insulin Production
• Ketoacidosis Not Common
• Adults p 40 Most Often
• Was Called Adult Onset Diabetes
• Familial
• May Need Insulin
Gestational
• During Pregnancy
• Goes Away p Pregnancy
• May Not Reoccur
• May Have BIG Baby
Mature Onset Diabetes of the Young (MODY)
• Impaired Insulin Production
• Ketoacidosis Not Common
• Strong Family HX of Type 2
• Same Characteristics as Type 2
DX
"↓ or Ø Insulin" Secretion
ASSESSMENT
Type 1 & 2
3-P's
Polyphagia
Polydipsia
Polyuria
Fatigue
↑ UTI's
Type 2
- Wt. ↑
- Eye Problems
- Slow Onset
Type 1
- Wt. ↓
- ↑ Thirst
- Bed Wetting
- Rapid Onset
DX
FBG > 126 mg/dl
Confirmd by repeat testing on another day
or
Casual or random glucose > 200 mg/dl + symptoms
or
Glucose tolerance test > 200 mg/dl
COMPLICATIONS
Insulin
• Hypoglycemia
• Lipodystrophy
• Somogyi Effect
• Allergic Reaction
Poorly Controlled Diabetes
• Diabetic Ketoacidosis (Type 1)
• Hyperosmolar Hyperglycemia Non-Ketotic Coma (Type 2)
• Fluid & Electrolyte Imbalance
Long Term
• Angiopathy
• Peripheral Vascular Disease
• Retinopathy
• Nephropathy
• Neuropathy
• Infections
TREATMENT
Insulin
Oral Hypoglycemics
Diet
↓ Insulin Need ← Exercise
↓ Glucose Fluctuation
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WWW.DIABETES.ORG/DIABETESCARE

JANUARY 2020

13. Children and Adolescents: *Standards of Medical Care in Diabetes—2020*

American Diabetes Association

Diabetes Care 2020;43(Suppl. 1):S163–S182 | https://doi.org/10.2337/dc20-S013

Diabetes

- A diagnosis characterized by hyperglycemia resulting from the body's inability to use blood glucose for energy.
- In Type 1 diabetes, the pancreas no longer makes insulin. Blood glucose cannot enter the cells to be used for energy.
- In Type 2 diabetes, either the pancreas does not make enough insulin or the body is unable to use insulin correctly.

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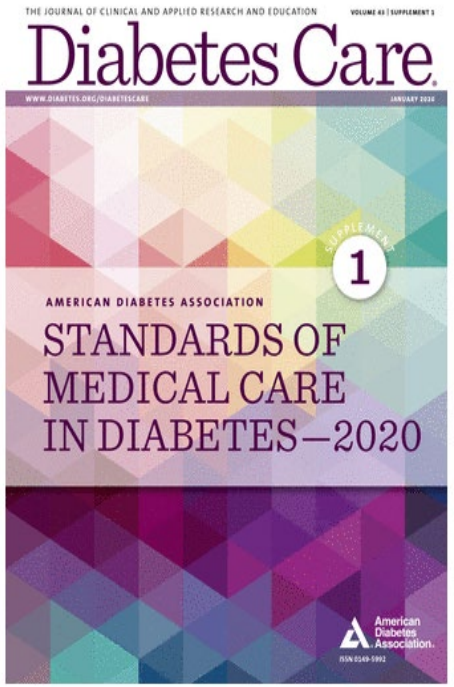
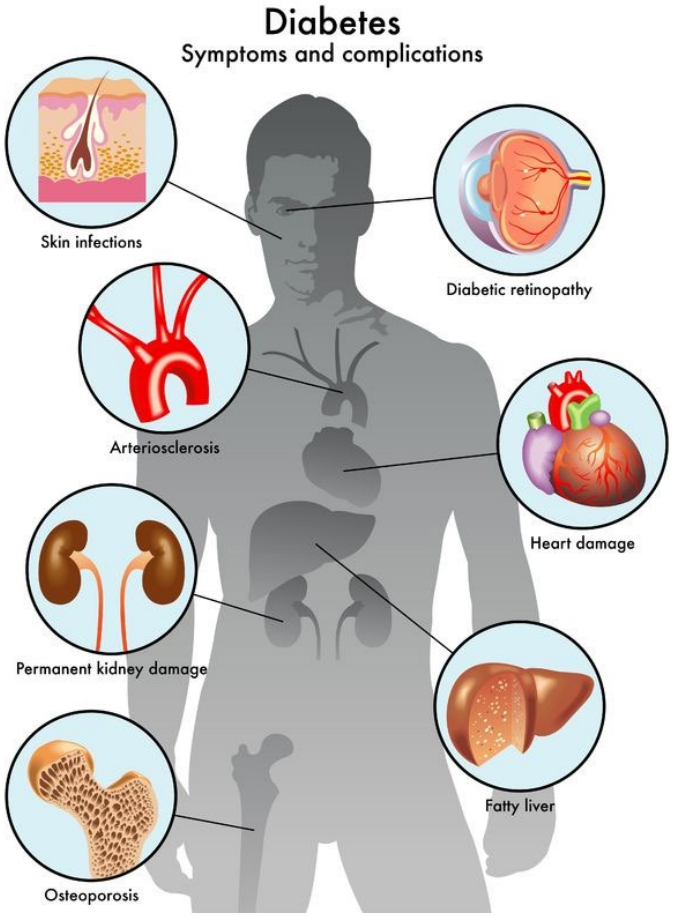


Cover: Credit: (c) cienpiesnf - stock.adobe.com.


Diabetes
Symptoms and complications
Skin infections
Diabetic retinopathy
Arteriosclerosis
Heart damage
Permanent kidney damage
Fatty liver
Osteoporosis

DIABETES INDICATORS
Criteria for the Diagnosis of Diabetes

Table 2.2—Criteria for the diagnosis of diabetes

FPG ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h.*
OR
2-h PG ≥200 mg/dL (11.1 mmol/L) during OGTT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.*
OR
A1C ≥6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.*
OR
In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dL (11.1 mmol/L).

DCCT, Diabetes Control and Complications Trial; FPG, fasting plasma glucose; OGTT, oral glucose tolerance test; WHO, World Health Organization; 2-h PG, 2-h plasma glucose. *In the absence of unequivocal hyperglycemia, diagnosis requires two abnormal test results from the same sample or in two separate test samples.

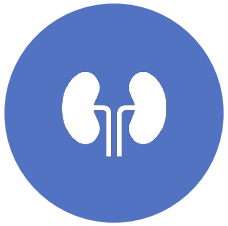
What is a Hemoglobin A1c (HgbA1c)?

REFLECTS AVERAGE GLUCOSE LEVEL OVER THE PAST

3 MONTHS

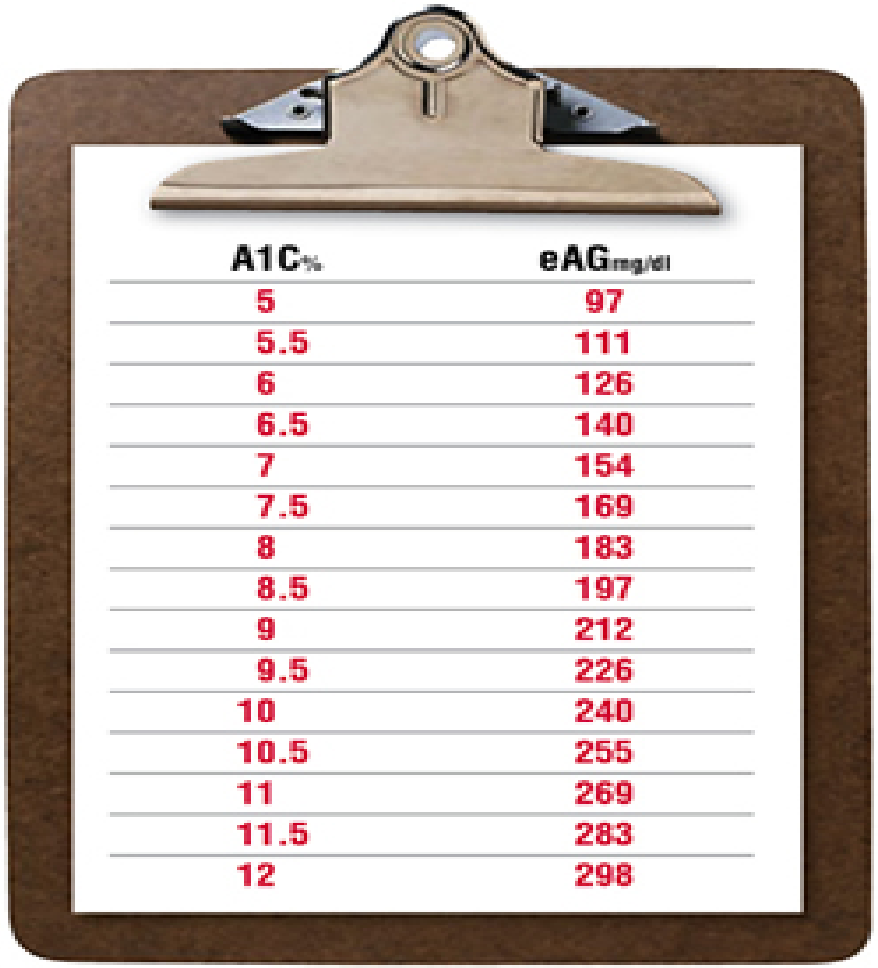
NOT UNCOMMON FOR HGBA1C

TO BE HIGH AT DIAGNOSIS



HGBA1C GOAL OF <7.5% IS RECOMMENDED ACROSS ALL PEDIATRIC AGE GROUPS

2019 ADA STANDARDS OF CARE (PEDIATRIC)

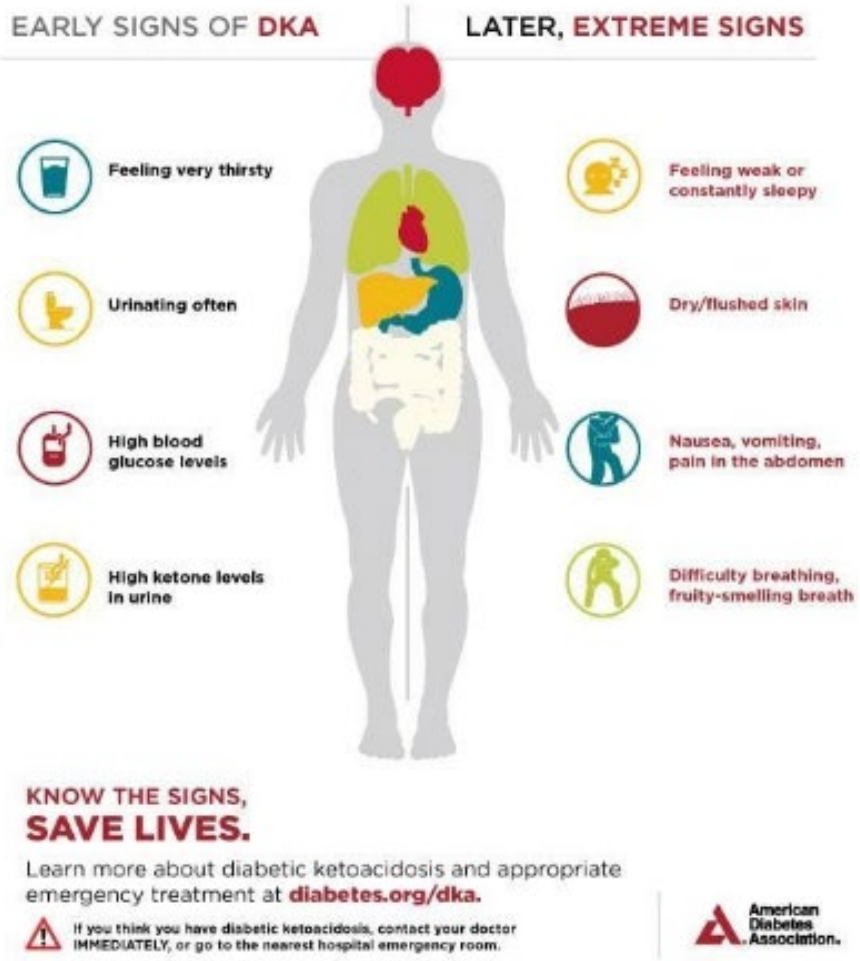


A1C%	eAG mg/dl
5	97
5.5	111
6	126
6.5	140
7	154
7.5	169
8	183
8.5	197
9	212
9.5	226
10	240
10.5	255
11	269
11.5	283
12	298

Estimated Average Glucose (eAG) and HgbA1c

What to Know about
Diabetic Ketoacidosis (DKA)

DKA is a serious condition that can result from untreated or undiagnosed diabetes or from too little insulin. It can lead to a diabetic coma or even death.



KNOW THE SIGNS,
SAVE LIVES.

Learn more about diabetic ketoacidosis and appropriate emergency treatment at **diabetes.org/dka.**

If you think you have diabetic ketoacidosis, contact your doctor IMMEDIATELY, or go to the nearest hospital emergency room.

American Diabetes Association.

What's the difference

Type 1 diabetes

The body cannot produce the insulin it needs

Causes unknown, but develops when the immune system attacks insulin producing cells[3]

Incidence is growing steadily

The symptoms often appear suddenly[3]

Usually diagnosed in children or young adults[3]

Must take insulin daily[3]

Type 2 diabetes

The body produces too little insulin and/or is unable to respond to it[3]

Risk factors include[3]:

- Advancing age
- Obesity
- Poor diet
- Family history of type 2 diabetes
- Physical inactivity
- Ethnicity

Incidence is rising at an epidemic rate[3]

The symptoms often appear gradually

Healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use can prevent or delay the onset of type 2 diabetes[4]

Often managed by exercise and a healthy diet or oral medication[3]
If the condition progresses, it can be treated with insulin[3]

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Type 1 Diabetes

- Chronic metabolic disorder
- Autoimmune process that destroys the beta cells of the pancreas
- Absolute insulin deficiency
- Diagnosis is confirmed by testing for antibodies:
  - Glutamic Acid Decarboxylase Autoantibodies (GAD 65)
  - Islet Cell Autoantibodies (ICA 512)
  - Zinc transporter 8 autoantibody (ZnT8Ab)

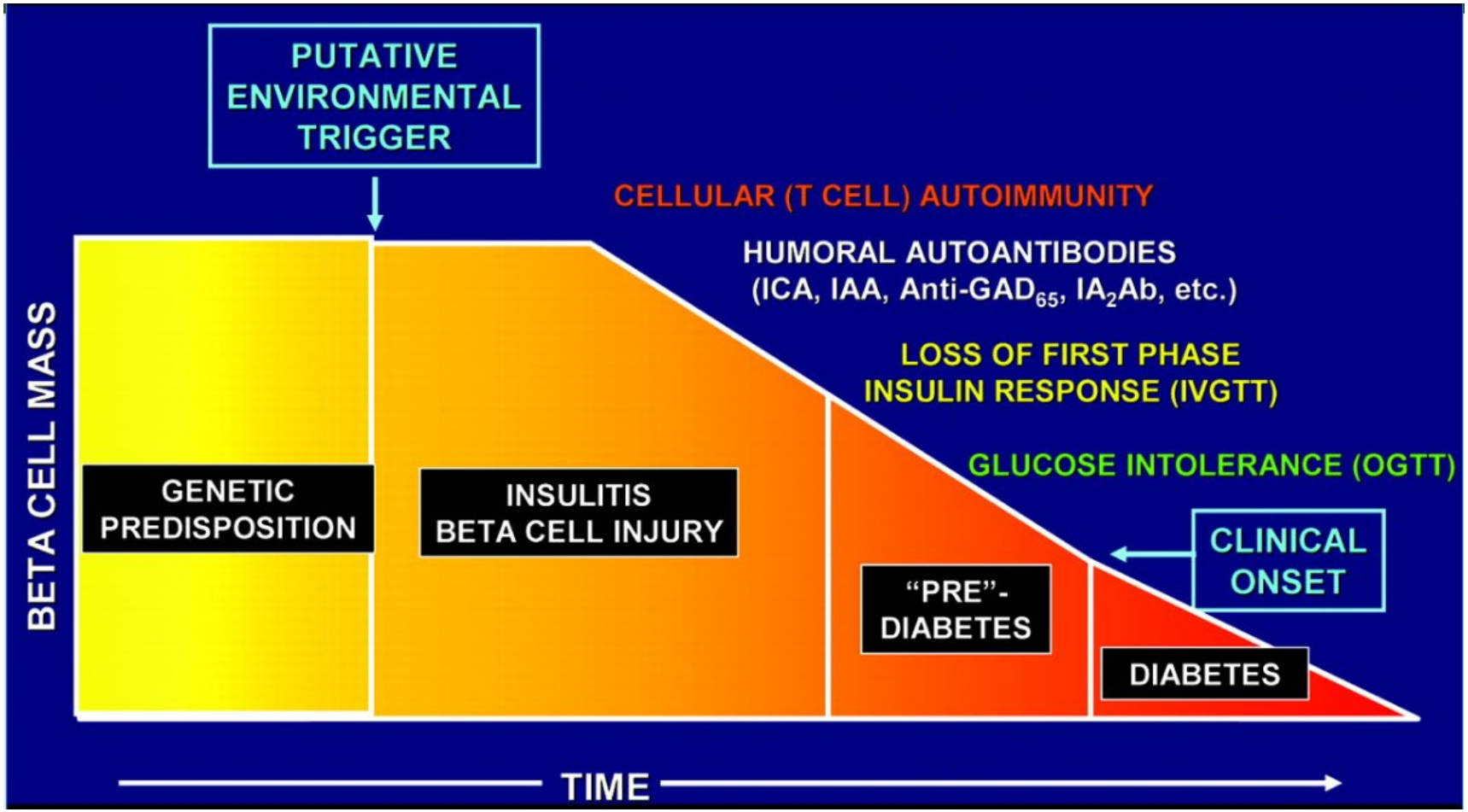

PUTATIVE ENVIRONMENTAL TRIGGER
CELLULAR (T CELL) AUTOIMMUNITY
HUMORAL AUTOANTIBODIES
(ICA, IAA, Anti-GAD65, IA2Ab, etc.)
LOSS OF FIRST PHASE INSULIN RESPONSE (IVGTT)
GLUCOSE INTOLERANCE (OGTT)
BETA CELL MASS
GENETIC PREDISPOSITION
INSULITIS BETA CELL INJURY
"PRE"-DIABETES
CLINICAL ONSET
DIABETES
TIME

Table 2.1—Staging of type 1 diabetes (8,9)

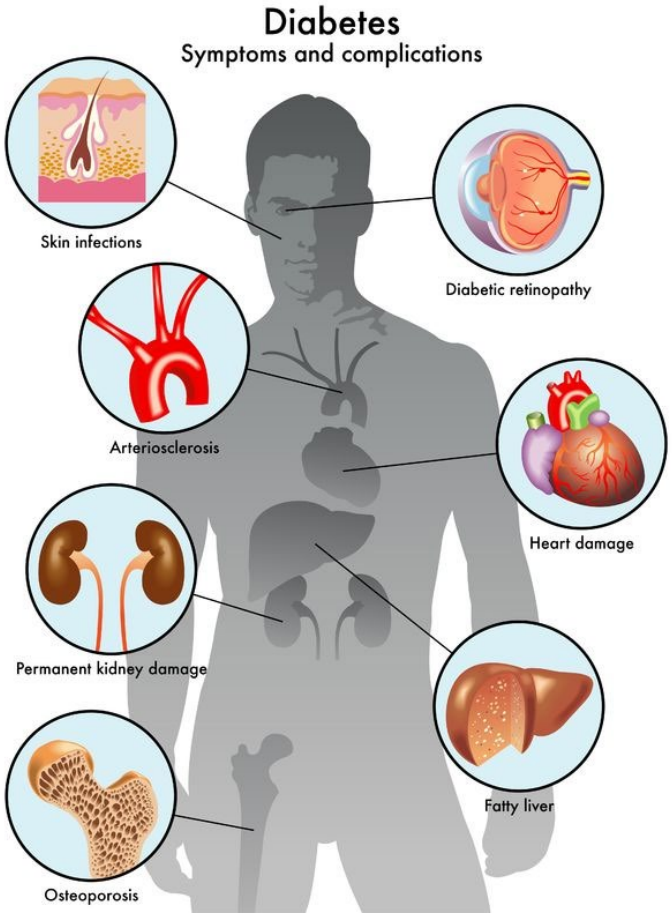
	Stage 1	Stage 2	Stage 3
Characteristics	• Autoimmunity • Normoglycemia • Presymptomatic	• Autoimmunity • Dysglycemia • Presymptomatic	• New-onset hyperglycemia • Symptomatic
Diagnostic criteria	• Multiple autoantibodies • No IGT or IFG	• Multiple autoantibodies • Dysglycemia: IFG and/or IGT • FPG 100–125 mg/dL (5.6–6.9 mmol/L) • 2-h PG 140–199 mg/dL (7.8–11.0 mmol/L) • A1C 5.7–6.4% (39–47 mmol/mol) or ≥10% increase in A1C	• Clinical symptoms • Diabetes by standard criteria

Table 13.1—Blood glucose and A1C targets for children and adolescents with type 1 diabetes

Blood glucose goal range			
Before meals	Bedtime/overnight	A1C	Rationale
90–130 mg/dL (5.0–7.2 mmol/L)	90–150 mg/dL (5.0–8.3 mmol/L)	<7.5% (58 mmol/mol)	A lower goal (<7.0% [53 mmol/mol]) is reasonable if it can be achieved without excessive hypoglycemia

Key Concepts in Setting Glycemic Targets

- Targets should be *individualized*, and lower targets may be reasonable based on a benefit-risk assessment.
- Blood glucose targets should be modified in children with frequent hypoglycemia or hypoglycemia unawareness.
- Postprandial blood glucose values should be measured when there is a discrepancy between preprandial blood glucose values and A1C levels and to assess preprandial insulin doses in those on basal-bolus or pump regimens.



- Thyriod function tests (TSH/Free T4)
- Lipid Panel
- Transglutaminase IgA
- Vitamin D
- Microalbumin/Creatinine ratio
- Hemoglobin A1c

Pre- Diabetes

Table 2.5—Criteria defining prediabetes*
FPG 100 mg/dL (5.6 mmol/L) to 125 mg/dL (6.9 mmol/L) (IFG)
OR
2-h PG during 75-g OGTT 140 mg/dL (7.8 mmol/L) to 199 mg/dL (11.0 mmol/L) (IGT)
OR
A1C 5.7–6.4% (39–47 mmol/mol)

FPG, fasting plasma glucose; IFG, impaired fasting glucose; IGT, impaired glucose tolerance; OGTT, oral glucose tolerance test; 2-h PG, 2-h plasma glucose. *For all three tests, risk is continuous, extending below the lower limit of the range and becoming disproportionately greater at the higher end of the range.

2020 ADA Standards of Care (Pediatric)

Type 2 Diabetes

Table 2.4—Risk-based screening for type 2 diabetes or prediabetes in asymptomatic children and adolescents in a clinical setting (163)

Testing should be considered in youth* who have overweight (≥85th percentile) or obesity (≥95th percentile) **A** and who have one or more additional risk factors based on the strength of their association with diabetes:

- Maternal history of diabetes or GDM during the child's gestation **A**
- Family history of type 2 diabetes in first- or second-degree relative **A**
- Race/ethnicity (Native American, African American, Latino, Asian American, Pacific Islander) **A**
- Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, polycystic ovary syndrome, or small-for-gestational-age birth weight) **B**

GDM, gestational diabetes mellitus. *After the onset of puberty or after 10 years of age, whichever occurs earlier. If tests are normal, repeat testing at a minimum of 3-year intervals, or more frequently if BMI is increasing, is recommended. Reports of type 2 diabetes before age 10 years exist, and this can be considered with numerous risk factors.

2020 ADA Standards of Care (Pediatric)

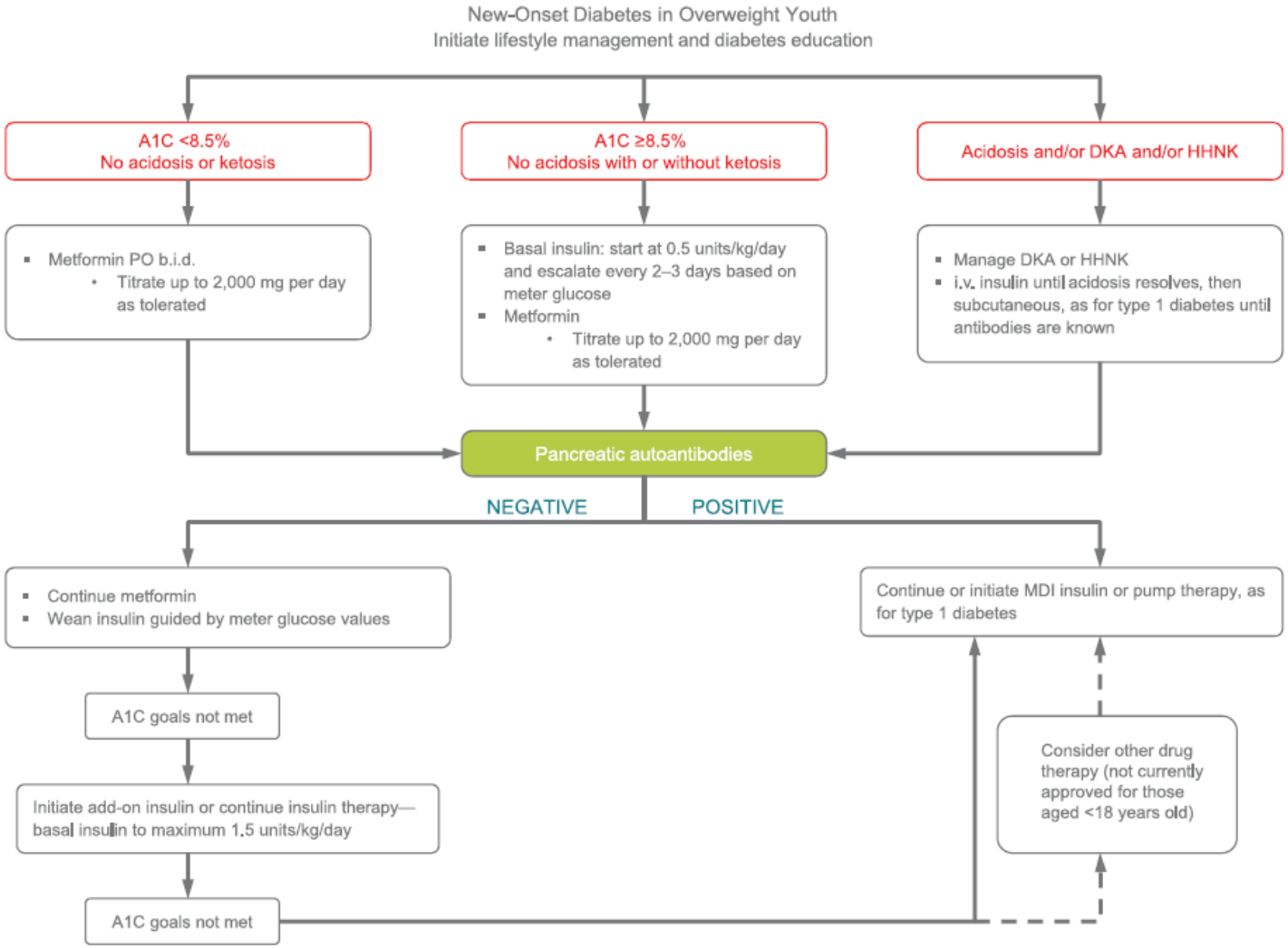
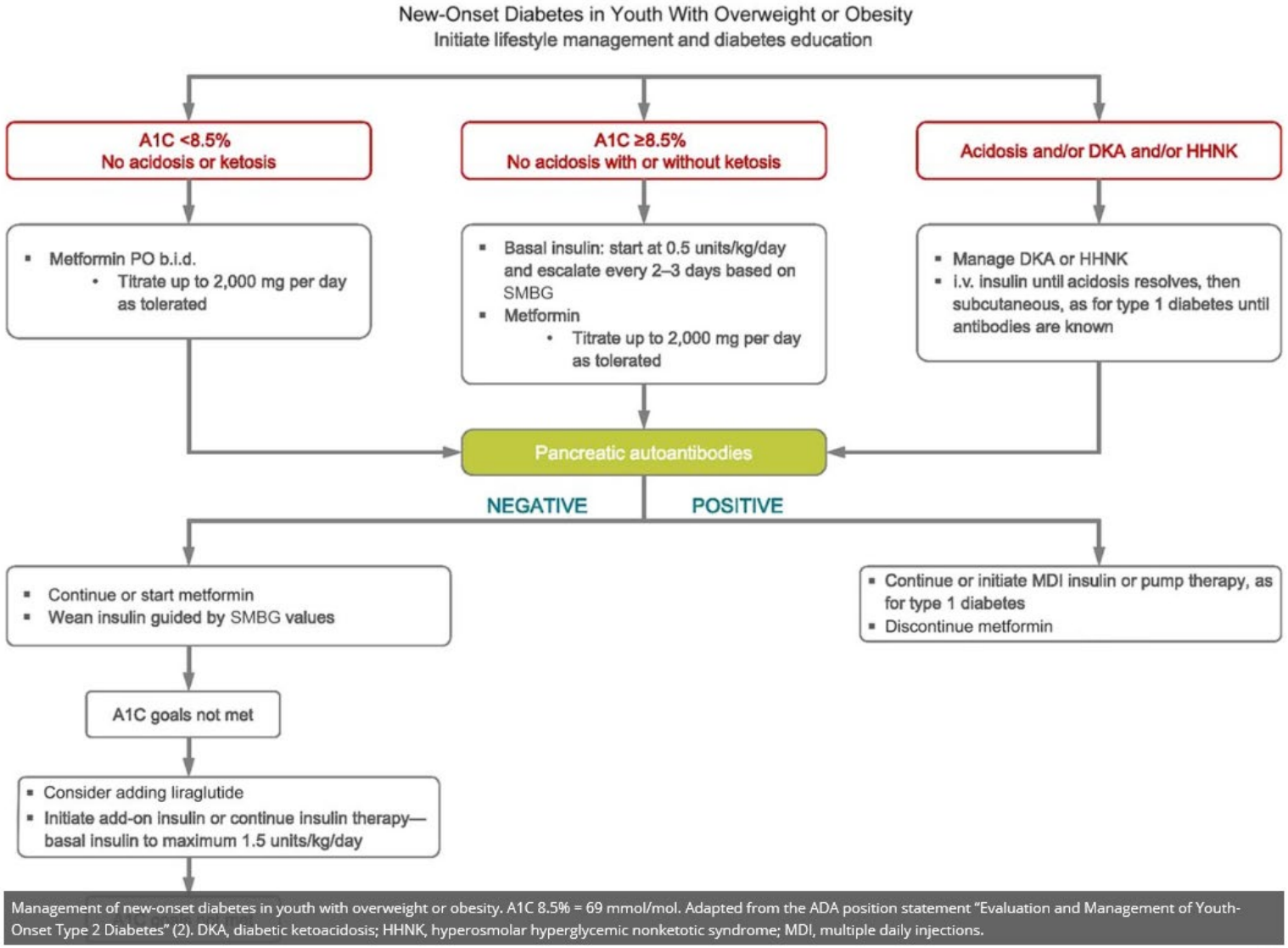


Figure 13.1—Management of new-onset diabetes in overweight youth (2). A1C 8.5% = 69 mmol/mol. DKA, diabetic ketoacidosis; HHNK, hyperosmolar hyperglycemic nonketotic syndrome; MDI, multiple daily injections.

2019 ADA Standards of Care (Pediatric)



Management of new-onset diabetes in youth with overweight or obesity. A1C 8.5% = 69 mmol/mol. Adapted from the ADA position statement "Evaluation and Management of Youth-Onset Type 2 Diabetes" (2). DKA, diabetic ketoacidosis; HHNK, hyperosmolar hyperglycemic nonketotic syndrome; MDI, multiple daily injections.

2020 ADA Standards of Care (Pediatric)

MODY

Maturity-Onset Diabetes of the Young
MODY is frequently characterized by onset of hyperglycemia at an early age (classically before age 25 years, although diagnosis may occur at older ages). MODY is characterized by impaired insulin secretion with minimal or no defects in insulin action (in the absence of coexistent obesity). It is inherited in an autosomal dominant pattern with abnormalities in at least 13 genes on different chromosomes identified to date. The most commonly reported forms are GCK-MODY (MODY2), HNF1A-MODY (MODY3), and HNF4A-MODY (MODY1).

Table 2.7—Most common causes of monogenic diabetes (119)

	Gene	Inheritance	Clinical features
MODY			
	GCK	AD	GCK-MODY: stable, nonprogressive elevated fasting blood glucose; typically does not require treatment; microvascular complications are rare; small rise in 2-h PG level on OGTT (<54 mg/dL [3 mmol/L])
	HNF1A	AD	HNF1A-MODY: progressive insulin secretory defect with presentation in adolescence or early adulthood; lowered renal threshold for glucosuria; large rise in 2-h PG level on OGTT (>90 mg/dL [5 mmol/L]); sensitive to sulfonylureas
	HNF4A	AD	HNF4A-MODY: progressive insulin secretory defect with presentation in adolescence or early adulthood; may have large birth weight and transient neonatal hypoglycemia; sensitive to sulfonylureas
	HNF1B	AD	HNF1B-MODY: developmental renal disease (typically cystic); genitourinary abnormalities; atrophy of the pancreas; hyperuricemia; gout

Genetic testing required

2019 ADA Standards of Care (Pediatric)

CFRD

CYSTIC FIBROSIS–RELATED DIABETES

Recommendations

2.14 Annual screening for cystic fibrosis–related diabetes (CFRD) with an oral glucose tolerance test should begin by age 10 years in all patients with cystic fibrosis not previously diagnosed with CFRD. **B**

2.15 A1C is not recommended as a screening test for cystic fibrosis–related diabetes. **B**

2.16 Patients with cystic fibrosis–related diabetes should be treated with insulin to attain individualized glycemic goals. **A**

2.17 Beginning 5 years after the diagnosis of cystic fibrosis–related diabetes, annual monitoring for complications of diabetes is recommended. **E**

2020 ADA Standards of Care (Pediatric)

Carbohydrate Counting : A key to success

- Macronutrient supplying 4 kcals/gram
- Made of carbon, hydrogen, oxygen
- Important mainly as an *energy* source
- Responsible for largest increase in blood sugar (more than fat and protein)
- Found in starches, fruits, dairy products, some vegetables

13.4 Comprehensive nutrition education at diagnosis, with annual updates, by an experienced registered dietitian nutritionist is recommended to assess caloric and nutrition intake in relation to weight status and cardiovascular disease risk factors and to inform macronutrient choices. **E**

2020 ADA Standards of Care (Pediatric)

Carbohydrate Counting : A key to success

- Carbohydrate counting is a tool that helps to identify and measure the amount of carbohydrate foods eaten
- Carbohydrate is the food source most concerning to people with diabetes because it is the main nutrient that rapidly change blood glucose
- Over 90% of carbohydrates eaten are converted into blood glucose in 1-2 hours

2020 ADA Standards of Care (Pediatric)

** Sugar Free does not mean carbohydrate free!!**

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INSULIN


NovoLog


12:25
BG
5.8 mmol/L
Bolus 3.450 u
Total 5.000 u
Stop Bolus
Basal

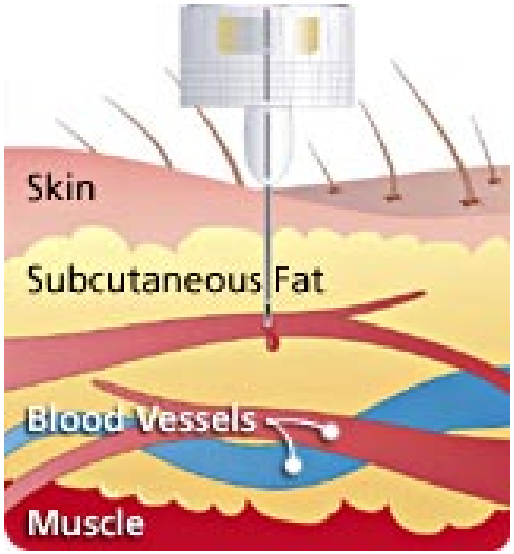

OmniPod
3:00p 2/11
Bolus
More actions
Temp basal
My records
Settings
Suspend
Status
Select

Insulin

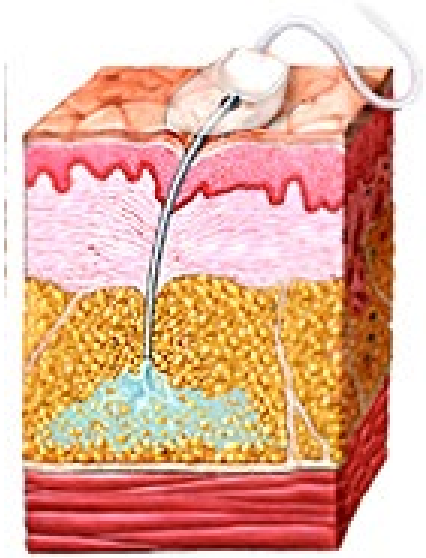
- Insulin is an anabolic hormone
- Produced by the pancreatic beta cells in the islets of Langerhans
- First discovered in 1921 by Dr. Fredrick Banting and Charles Best
- First used a pancreatic extract to treat dogs with diabetes and then the following summer in a 14 year old boy

Insulin

- Essential to process carbohydrates
- Decreases blood glucose
- Facilitates glucose into tissues (muscle/adipose)
- Stimulates the liver to store glucose in the form of glycogen
- Promotes synthesis of fatty acids in the liver
- Inhibits the breakdown of fat in adipose tissue, therefore stimulating fat storage



Insulin pen injector



External insulin pump

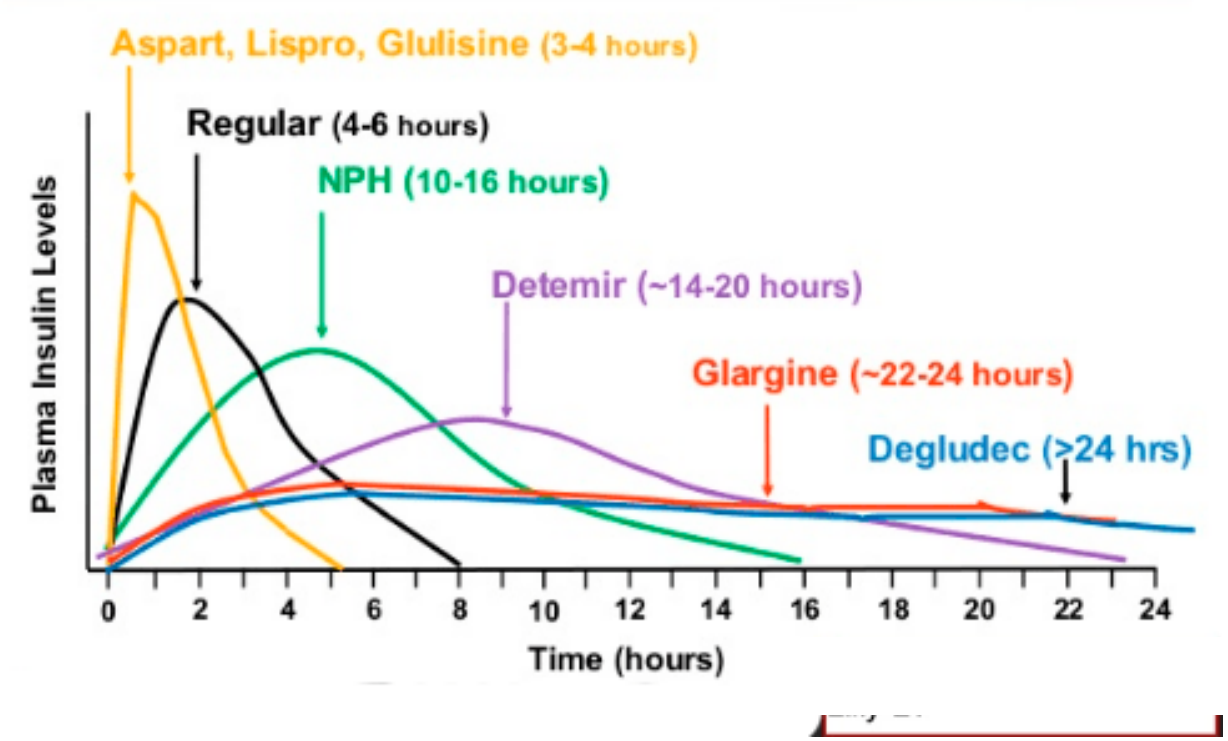
http://trihealth.adam.com/graphics/images/en/19210.jpg

Types of Insulin

- Short
- Rapid
- Intermediate
- Long
- Premixed
- Inhaled

Insulin type	How it is delivered	Expiration when opened	Onset	Peak	Duration
Rapid Acting					
Admelog	Pens and vials	28 days	15-30 min	30 min-2 ½ hours	4-5 hours
Afrezza inhaled powder	4, 8 and 12 unit Cartridges	3 days	3-7 minutes	12-15 min	1 ½-3 hours
Apidra	Vials and pens	28 days	10-20 min	30 min-1 ½ hours	2-4 hours
Fiasp	Vials and pens	28 days	15-20 min	1 ½- 2 hours	5 hours
Humalog, U-100 and U-200	Vials, pens, cartridges for refillable pen	28 days	10-20 min	30 min-1/12 hours	3-5 hours
Novolog	Vials, pens, cartridges for refillable pen	28 days	10-20 min	1-3 hours	3-5 hours
Short Acting **					
Regular	Vials and pens	31-42 days, depending upon brand	15-30 min	2 ½-5 hours	4-12 hours
U-500 (5x the concentration)	Vials and pens	28 days	30 min	4-8 hours	18-24 hours
Intermediate acting **					
NPH (created in 1946)	Vials and pens	31-42 days, depending upon brand	1-2 hours	4-12 hours	14-24 hours
Long acting					
Basaglar	Vials and pens	28 days	3-4 hours	No peak +	11-24 hours
Lantus	Vials and pens	28 days	3-4 hours	No peak +	11-24 hours
Levemir	Vials and pens	42 days	3-4 hours	No peak +	6-23 hours
Toujeo, U-300	Pen only	42 days	6 hours	No peak	24-36 hours
Tresiba, U-100 and U-200	Pen only	56 days	1 hour	9 hours	36-42 hours
Combination					
NPH/Regular 70/30	Vials and pens	31-42 d vial 10 d pen	30 min	50 min- 2 hours and 6-10 hours	18-24 hours
Rapid acting 70/30	Vials and pens	28 d vial 14 d pen	15-30 min	1-4 hours	18-24 hours
Rapid acting 75/25	Vials and pens	28 d vial 10 d pen	15-30 min	1-6 ½ hours	12-24 hours
Rapid acting 50/50	Vials and pens	28 d vial 10 d pen	15-30 min		

https://www.ontrackdiabetes.com/blood-glucose/insulin-basics



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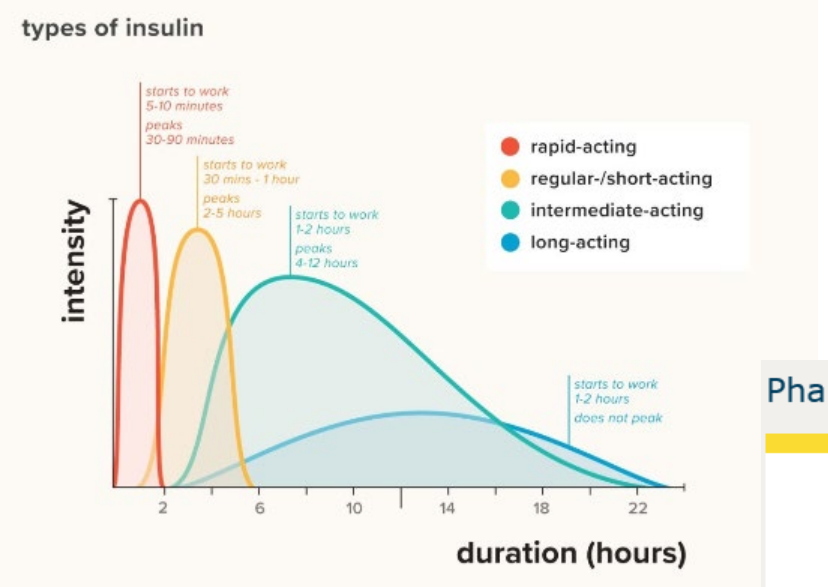

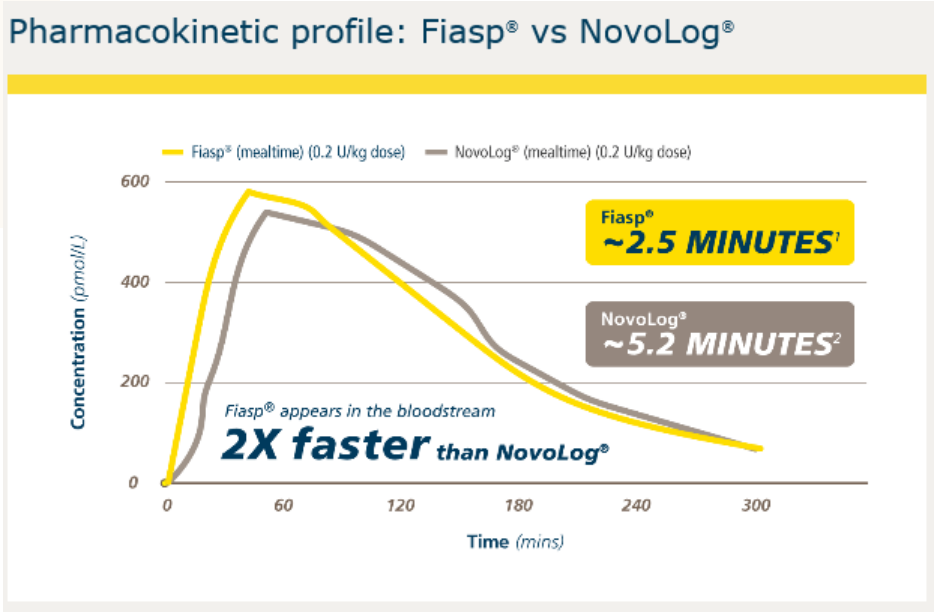

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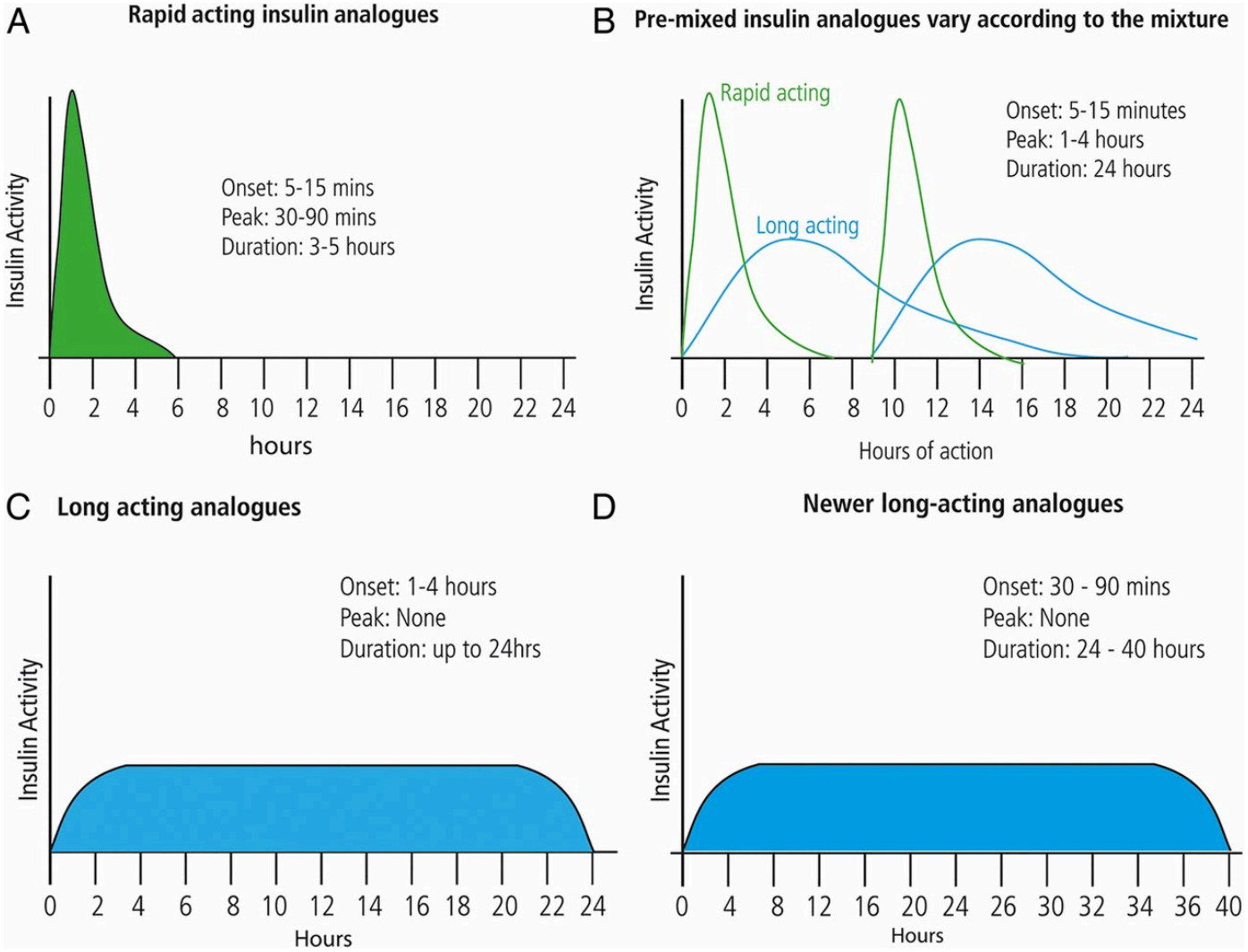
Basal vs. Bolus: The Difference

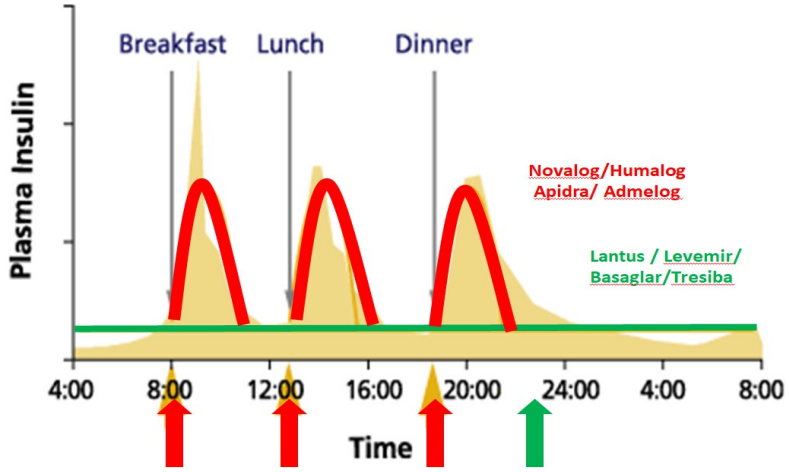
Basal Insulin

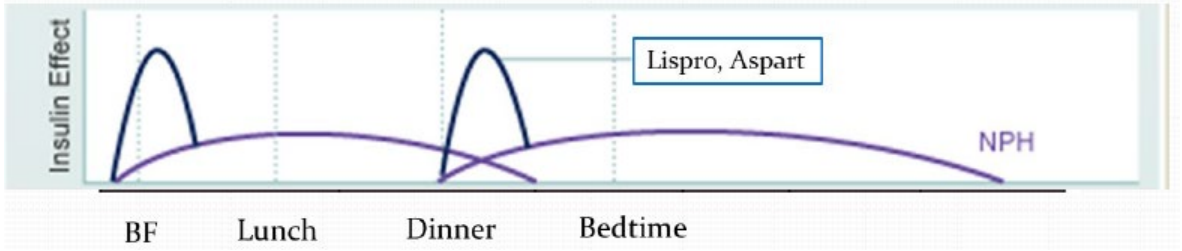
- Intended to mimic normal pancreatic secretion
- Long lasting effect 18-24 hours
- Smooth and peakless
- Reduced risks of nocturnal hypoglycemia
- Once per day administration

Bolus Insulin

- Intended to be rapid onset
- Short duration of action
- Meal time insulin
- Correction insulin
- Predictable action profile


A
Rapid acting insulin analogues
Insulin Activity
Onset: 5-15 mins
Peak: 30-90 mins
Duration: 3-5 hours
0 2 4 6 8 10 12 14 16 18 20 22 24
hours
B
Pre-mixed insulin analogues vary according to the mixture
Rapid acting
Long acting
Insulin Activity
Onset: 5-15 minutes
Peak: 1-4 hours
Duration: 24 hours
0 2 4 6 8 10 12 14 16 18 20 22 24
Hours of action
C
Long acting analogues
Insulin Activity
Onset: 1-4 hours
Peak: None
Duration: up to 24hrs
0 2 4 6 8 10 12 14 16 18 20 22 24
Hours
D
Newer long-acting analogues
Insulin Activity
Onset: 30 - 90 mins
Peak: None
Duration: 24 - 40 hours
0 4 8 12 16 20 24 26 30 32 34 36 40
Hours

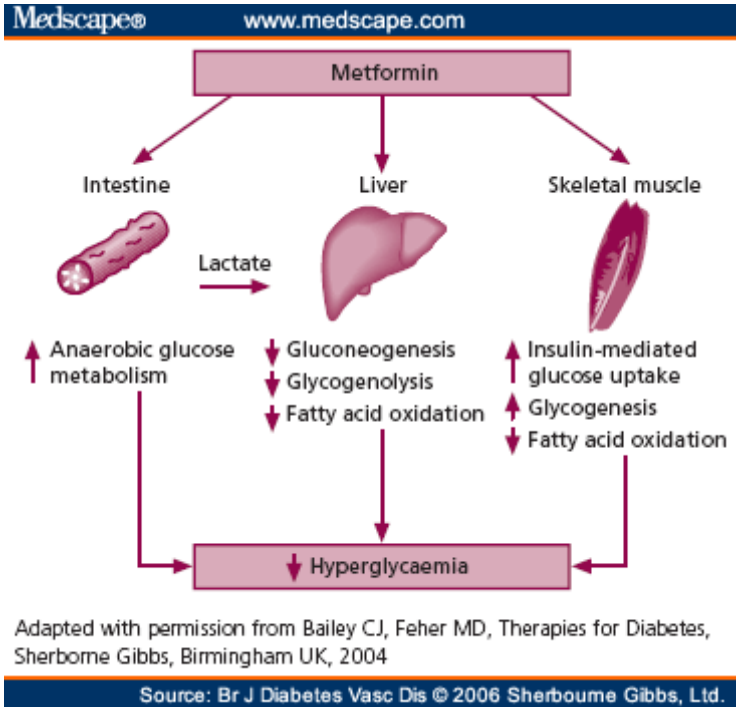

Breakfast
Lunch
Dinner
Plasma Insulin
Novalog/Humalog
Apidra/ Admelog
Lantus / Levemir/
Basaglar/Tresiba
4:00
8:00
12:00
16:00
20:00
24:00
4:00
8:00
Time


Insulin Effect
Lispro, Aspart
NPH
BF
Lunch
Dinner
Bedtime

Oral Hypoglycemics: Indications for use

- Failure of diet and lifestyle therapy
- Partially functioning pancreas/Endogenous insulin production
- Type 2 diabetes
- Steroid induced diabetes
- MODY
- Can be used in monotherapy or in combination with insulin

Metformin (Glucophage)



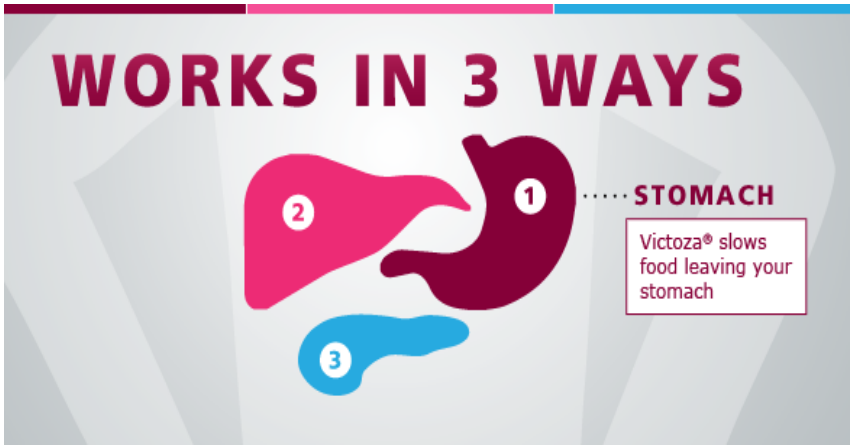
- Belongs to class BIGUANIDES
- Used alone or with insulin to improve sensitivity
- Available in liquid and tab form
- Available as extended release formulations
- Approved for use in children (2000)

Metformin – Side effects

- Common
  - Diarrhea
  - Gas
  - Heartburn
  - Nausea
  - Abdominal pain
- Severe
  - Confusion
  - Drowsiness/Dizziness
  - Difficulty breathing
  - Weakness
  - Increased heart rate
  - Vomiting
  - Fatigue
  - Unusual muscle pain

Glucagon-like Peptide-1 (GLP-1) Receptor Agonists

- Liraglutide (Victoza)
- Approved by the FDA 2019 for children >10 years of age with T2DM
- Incretin mimetic agent that elicits glucagon like peptide-1 (GLP-1) receptor agonist activity



Victoza- Side effects

- Common
  - Nausea
  - Diarrhea
  - Vomiting
  - Constipation
  - Headache
  - Dyspepsia
  - Injection site reaction
- Severe
  - Thyroid C-cell tumor
  - Papillary thyroid carcinoma
  - Nephrotoxicity
  - Pancreatitis
  - Hypoglycemia

Recent FDA approval

- Baqsimi

Giving the dose

Hold Device between fingers and thumb.

Do not push Plunger yet.

Insert Tip gently into one nostril until finger(s) touch the outside of the nose.

Push Plunger firmly all the way in.

Dose is complete when the Green Line disappears.

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Recent FDA approval

- Gvoke
  - Premixed, prefilled, premeasured
  - 2 doses: 1.0 mg and 0.5 mg
  - No refrigeration

Gvoke HypoPen™ (glucagon injection) | Gvoke™ PFS (glucagon injection) PRE-FILLED SYRINGE

GLUCOSE MONIOTRING

Glucose Monitoring

- Before meals
- Before going to bed
- Before driving
- Before physical activity
- School dismissal
- With symptoms of hypo/hyperglycemia

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	MORNING	AFTERNOON	EVENING	NIGHT	DAILY TOTALS
	12A 1 2 3 4 5 6A 7 8 9 10 11	12P 1 2 3 4 5 6P 7 8 9 10 11			
WED 11/21	115	122	192	161	BG (4): 148 mg/dL Carbs: 0.0 g Insulin: 0.0 U
TUE 11/20	118	97	161	166	BG (4): 136 mg/dL Carbs: 0.0 g Insulin: 0.0 U
MON 11/19	120	109	136	136	BG (4): 125 mg/dL Carbs: 0.0 g Insulin: 0.0 U
SUN 11/18	133	116	162	156	BG (4): 142 mg/dL Carbs: 0.0 g Insulin: 0.0 U
SAT 11/17	189 *	127	156	143	BG (5): 148 mg/dL Carbs: 0.0 g Insulin: 0.0 U
FRI 11/16	120	113	244 *	128	BG (5): 152 mg/dL Carbs: 0.0 g Insulin: 0.0 U
THU 11/15	130	94	168	151	BG (4): 136 mg/dL Carbs: 0.0 g Insulin: 0.0 U

AVG. MORNING (5AM - 10AM)	AVG. AFTERNOON (10AM - 3PM)	AVG. EVENING (3PM - 9PM)	AVG. NIGHT (9PM - 5
BG(15): 128.0 mg/dL	BG(13): 111.0 mg/dL	BG(27): 160.0 mg/dL	BG(0): 0.0 mg/dL
Carbs: 0 g	Carbs: 0 g	Carbs: 0 g	Carbs: 0 g
Insulin: 0.0	Insulin: 0.0	Insulin: 0.6	Insulin: 0.0

Glucose
- > 180
- < 70
- ● Before Meal
- O After Meal

Other
- Carb
- ★ Multiple Values (most extreme shown)

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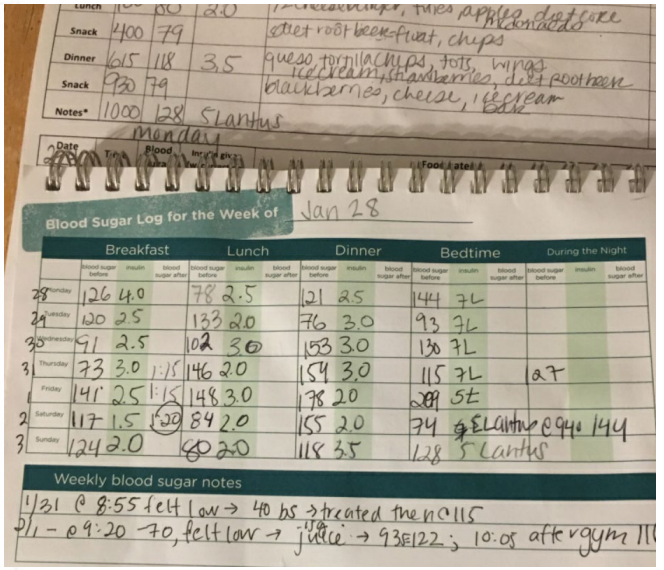

Comparison: Logbook/table

<70 mg/dl | within target area | >200 mg/dl | m tagged values were typed in manually by the patient | k ketones (mmol/L) | Bolus with correction | suspended | resumed | Temp. basal | Pump alarm | fill cannula | prime

	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Daily totals
Tu 7/25			318											167			246		258		62				Average (5): 210mg/dl Carbs: -- Insulin: -- Bolus: --
We 7/26	156				284											248		151			89		136		Average (6): 177mg/dl Carbs: -- Insulin: -- Bolus: --
Th 7/27				239										252			270						235		Average (4): 249mg/dl Carbs: -- Insulin: -- Bolus: --
Fr 7/28		205													182				347						Average (3): 245mg/dl Carbs: -- Insulin: -- Bolus: --
So 7/29	199			221						355				134			105						162		Average (7): 207mg/dl Carbs: -- Insulin: -- Bolus: --
																	275								
Su 7/30		48										282		239	169		142			114			109		Average (8): 150mg/dl Carbs: -- Insulin: -- Bolus: --
		95																							
Mo 7/31	140							367			180					496		242					131		Average (6): 259mg/dl Carbs: -- Insulin: -- Bolus: --
Tu 8/1	167							271			128					268			135		195	229			Average (7): 199mg/dl Carbs: -- Insulin: -- Bolus: --
We 8/2			157						327		165				233				257						Average (5): 228mg/dl
	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Daily totals

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CONTINUOUS GLUCOSE MONITORS

42

Factors That Affect BG

Food

- ↑↑ 1. Carbohydrate quantity
- →↑ 2. Carbohydrate type
- →↑ 3. Fat
- →↑ 4. Protein
- →↑ 5. Caffeine
- ↓↑ 6. Alcohol
- ↓↑ 7. Meal timing
- ↑ 8. Dehydration
- ? 9. Personal microbiome

Medication

- →↓ 10. Medication dose
- ↓↑ 11. Medication timing
- ↓↑ 12. Medication interactions
- ↑↑ 13. Steroid administration
- ↑ 14. Niacin (Vitamin B3)

Activity

- →↓ 15. Light exercise
- ↓↑ 16. High-intensity and moderate exercise
- →↓ 17. Level of fitness/training
- ↓↑ 18. Time of day
- ↓↑ 19. Food and insulin timing

diaTribe®

Biological

- ↑ 20. Insufficient sleep
- ↑ 21. Stress and illness
- ↓ 22. Recent hypoglycemia
- →↑ 23. During-sleep blood sugars
- ↑ 24. Dawn phenomenon
- ↑ 25. Infusion set issues
- ↑ 26. Scar tissue and lipodystrophy
- ↓↓ 27. Intramuscular insulin delivery
- ↑ 28. Allergies
- ↑ 29. A higher glucose level
- ↓↑ 30. Periods (menstruation)
- ↑↑ 31. Puberty
- ↓ 32. Celiac disease
- ↑ 33. Smoking

Environmental

- ↑ 34. Expired insulin
- ↑ 35. Inaccurate BG reading
- ↓↑ 36. Outside temperature
- ↑ 37. Sunburn
- ? 38. Altitude

Behavioral & Decision Making

- ↓ 39. Frequency of glucose checks
- ↓↑ 40. Default options and choices
- ↓↑ 41. Decision-making biases
- ↓↑ 42. Family relationships and social pressures

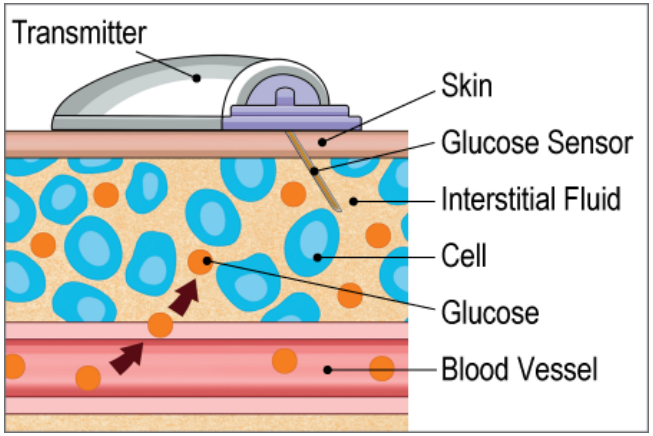
Continuous Glucose Monitors

- Continuous Glucose Monitors (CGM) provide continuous insight into glucose levels throughout the day and night

7.12 Continuous glucose monitoring (CGM) should be considered in all children and adolescents with type 1 diabetes, whether using injections or continuous subcutaneous insulin infusion, as an additional tool to help improve glucose control. Benefits of CGM correlate with adherence to ongoing use of the device. **B**

Continuous Glucose Monitors

- Sensor is placed just below the skin and can be worn for 7-14 days*
- Measures the glucose in interstitial fluid
- Glucose readings are transmitted to a receiver (graph and numerical reading)
- Depending on the model the display device may be a cell phone, iPod, iPad, insulin pump or brand receiver



http://www.nbdiabetes.org/news/continuous-glucose-monitoring-system-cgms

CGM: The benefits

- Reduction of HgbA1c
- Less frequent hypoglycemia events
- Decreases the time spent in hypoglycemia
- Ability to see both glucose value trends
  - Value, direction and rate of change
- Adjustments to insulin delivery
  - Pumps: basal/bolus, advanced features
  - Injections: basal, carb counting

CGM: The benefits

- Less fear of hypoglycemia
- Higher satisfaction with treatment
- Seeing the effect of specific foods and activity
- Notice trends
- Transition to independence
- Ability to be more active in their own management
- More aggressive management style
- Alerts of highs and lows*

Why not…?

- Do not want something attached to body
- A second device
- Reminder of chronic disease
- Expense

Integrated Pumps

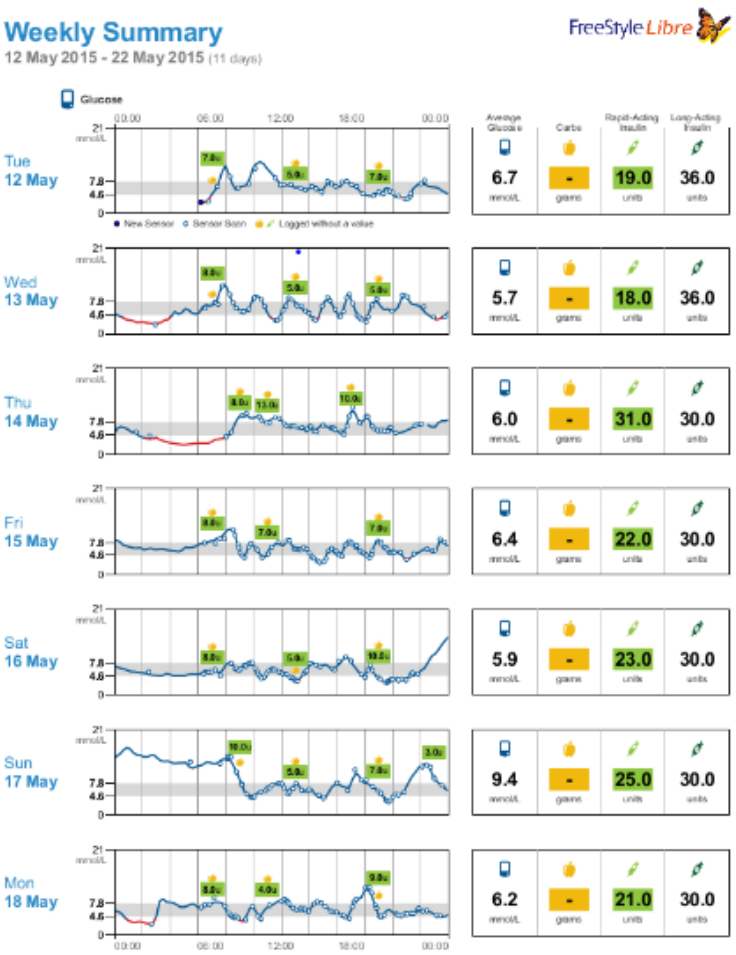
- Medtronic MiniMed 670G –Guardian Sensor
- Medtronic MiniMed 630G – Enlite Sensor
- Medtronic Paradigm Revel – Enlite Sensor
- Tandem t:slim x2 – Dexcom G6

Stand Alone CGM

- Medtronic Guardian Connect
- FreeStyle Libre
- Eversense
- Dexcom G5/G6

Freestyle Libre

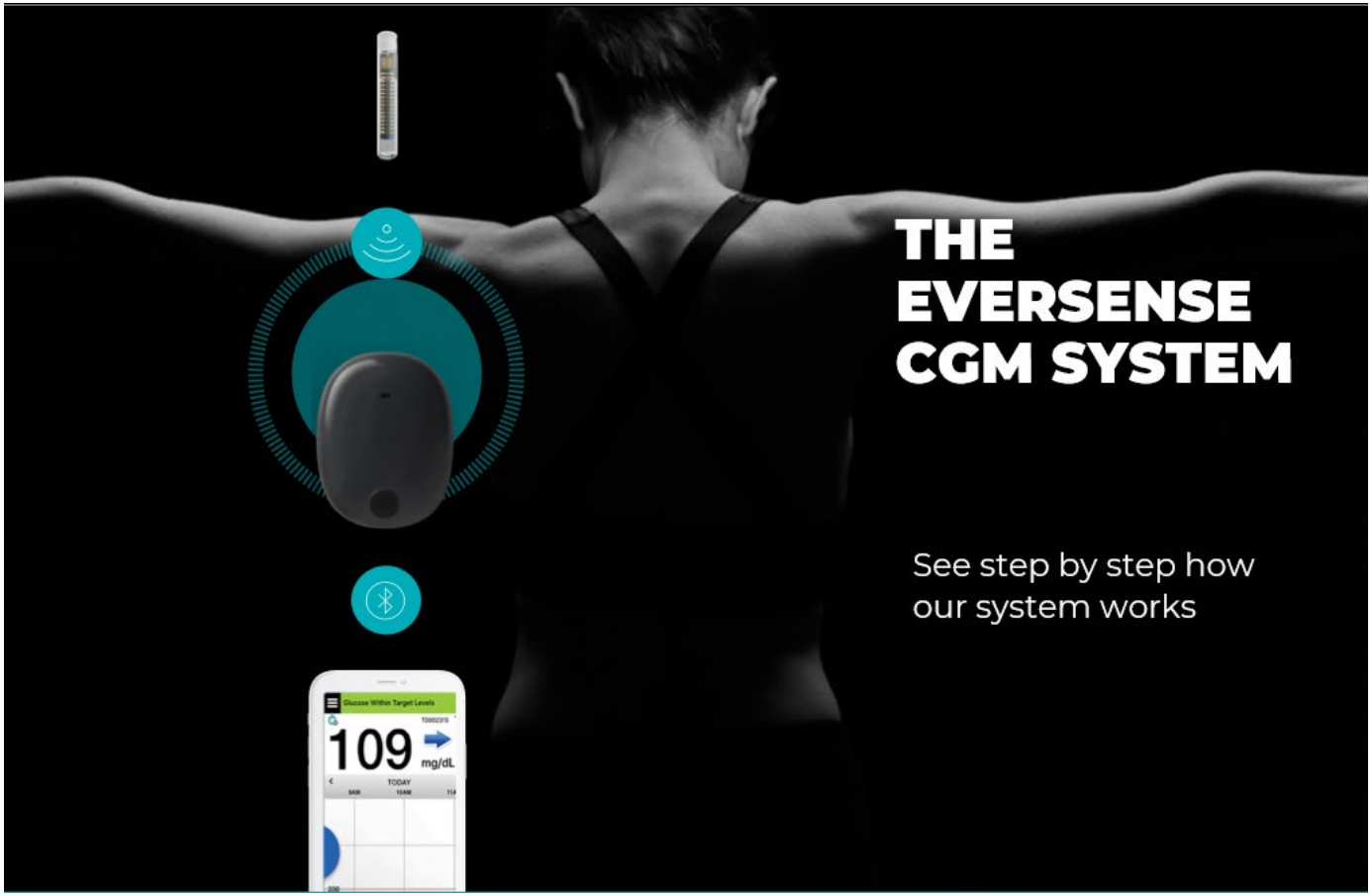
- FDA approved 18+ years
- No fingerstick calibrations
- Fingersticks required for treatment decisions
- No alarms
- Captures data every minute and records every 15 minutes
- Stores 90 days of data
- Download on LibreView


Weekly Summary
12 May 2015 - 22 May 2015 (11 days)
FreeStyle Libre
Glucose
Average Glucose
Carbs
Rapid-Acting Insulin
Long-Acting Insulin
Tue 12 May
6.7 mmol/L
- grams
19.0 units
36.0 units
Wed 13 May
5.7 mmol/L
- grams
18.0 units
36.0 units
Thu 14 May
6.0 mmol/L
- grams
31.0 units
30.0 units
Fri 15 May
6.4 mmol/L
- grams
22.0 units
30.0 units
Sat 16 May
5.9 mmol/L
- grams
23.0 units
30.0 units
Sun 17 May
9.4 mmol/L
- grams
25.0 units
30.0 units
Mon 18 May
6.2 mmol/L
- grams
21.0 units
30.0 units

Medtronic Guardian Connect

- Does not communicate with pump/stand alone sensor
- Uses Apple mobile device as receiver
- Seven day wear
- Calibration by finger stick after warm up, 6 hours after warm up and every 12 hours
- Sugar IQ App: Predictive high and low glucose alerts
- Rechargeable transmitter
- Caregiver data share

Eversense



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Dexcom G6

- Stand Alone Sensor
- FDA approved in ages 2+ years
- Glucose trends on receiver or sent to a mobile device
- Data is able to be shared with the Clarity App
- High and low alerts

100% of Sensors Undergo Performance Evaluation

Each sensor is labeled with a four digit code

Code entered through phone

Code results in accurate sensor glucose readings

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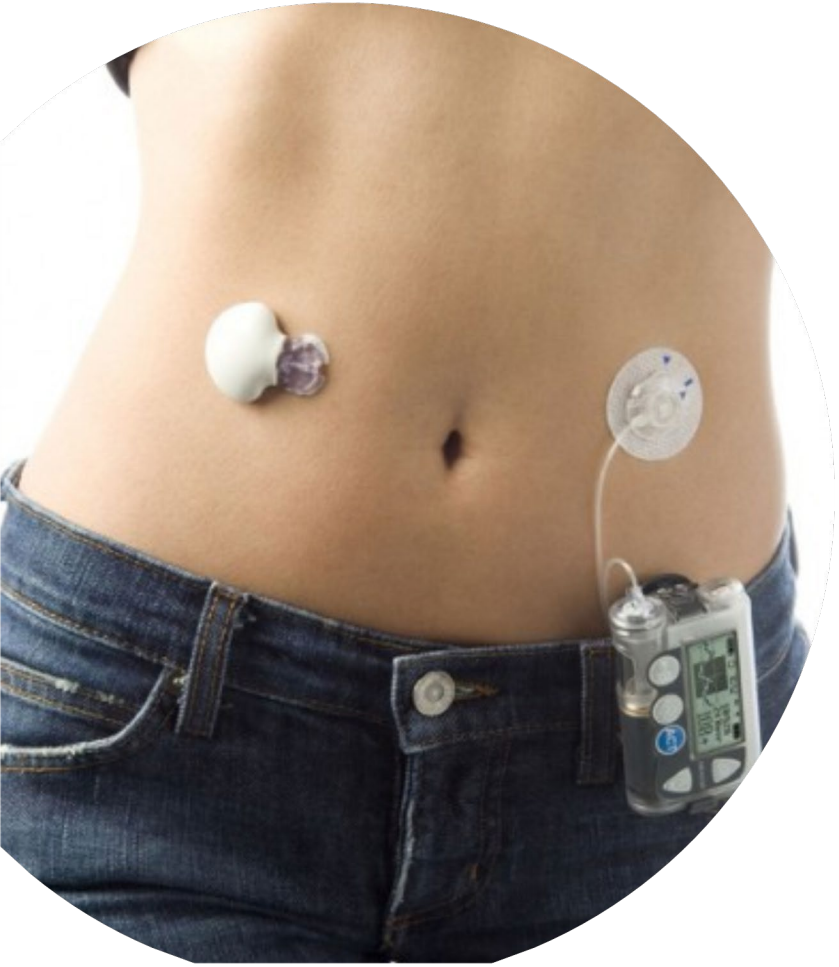
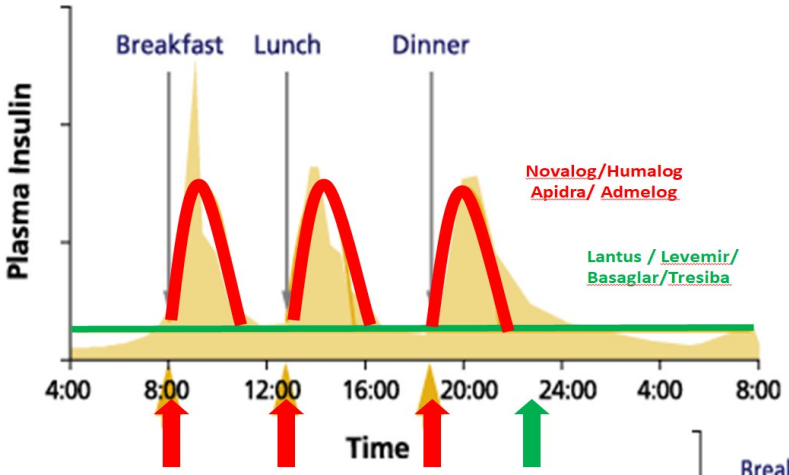
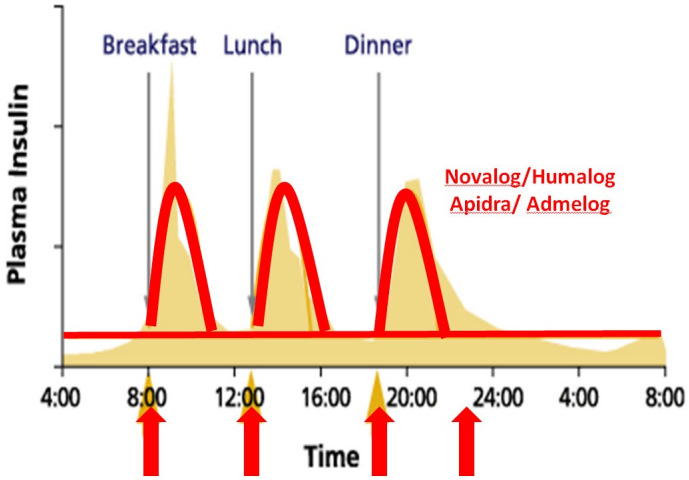


Insulin pumps

Injections vs Insulin pump





** No long acting insulin when using an insulin pump. If there is a pump failure- no long acting insulin on board**

Sensor for CGM
optional extra

Insulin vial to fill reservoir

Reservoir

Insulin Pump

Infusion set before insertion

Infusion set after insertion

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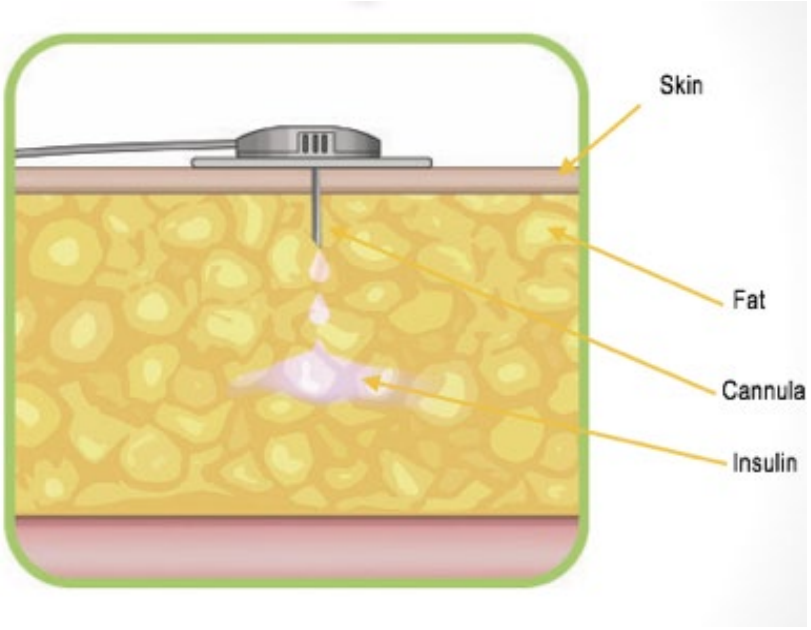

Skin
Fat
Cannula
Insulin

Omni Pod

Medtronic

T-slim

Omnipod: features

- No tubing
- Pod (pump) includes infusion set with automatic insertion
- All programming done via PDM
- 200 unit reservoir
- Integrated Freestyle glucose meter

Omnipod Dash

MiniMed 670G System

MiniMed 630G System

MiniMed 530G System

Medtronic Integrated Sensors:

Enlite

Guardian 3

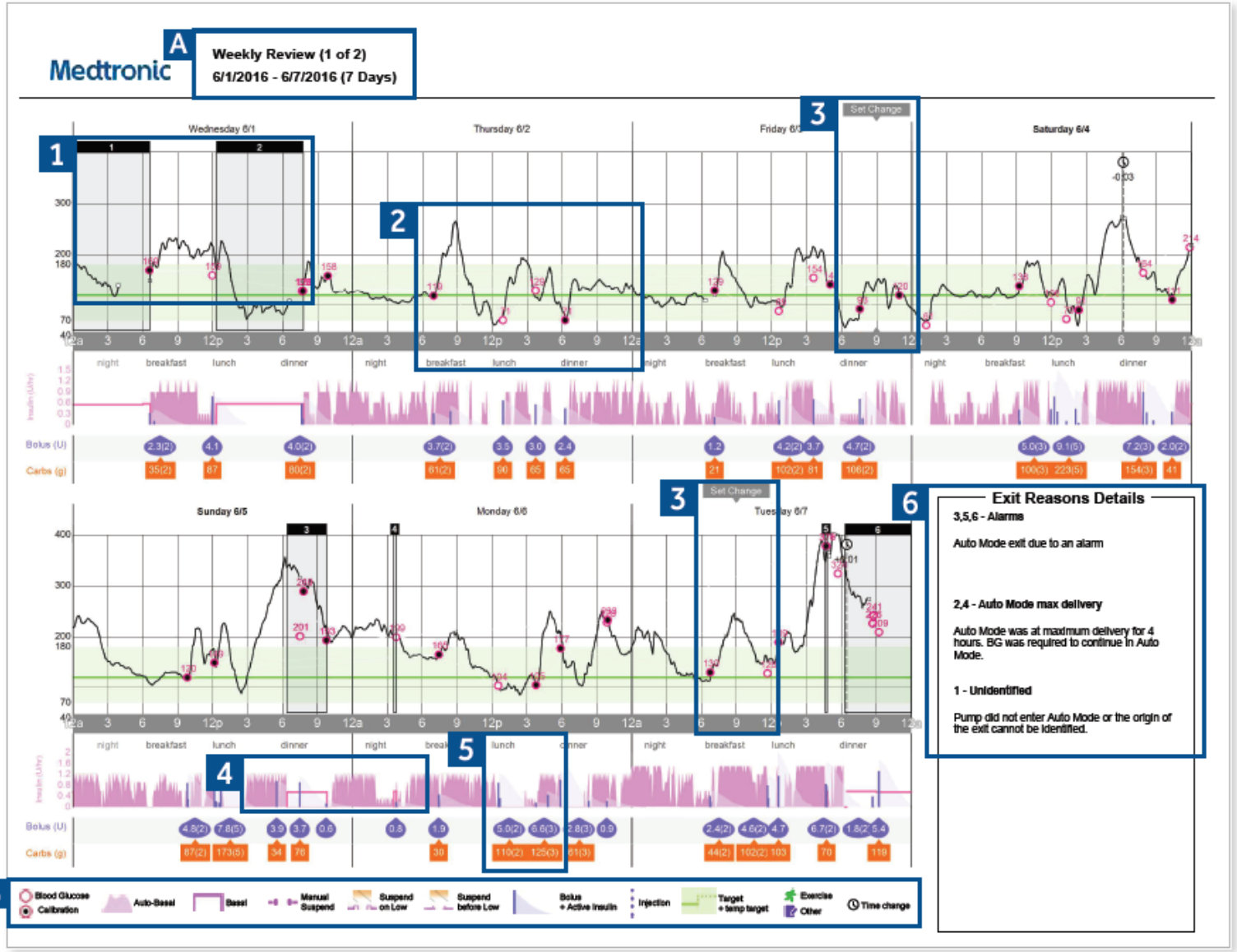
NEW GUARDIAN SENSOR 3
TRUSTED TO POWER A HYBRID CLOSED LOOP SYSTEM

- New diagnostic technology
- Enhanced accuracy
- Advanced performance
- Longer life – 7 day wear
- Only sensor approved to drive insulin delivery

Both sensor & transmitter look similar to Enlite on the outside, but very different on the inside.

Medtronic

Understanding the Weekly Review Report

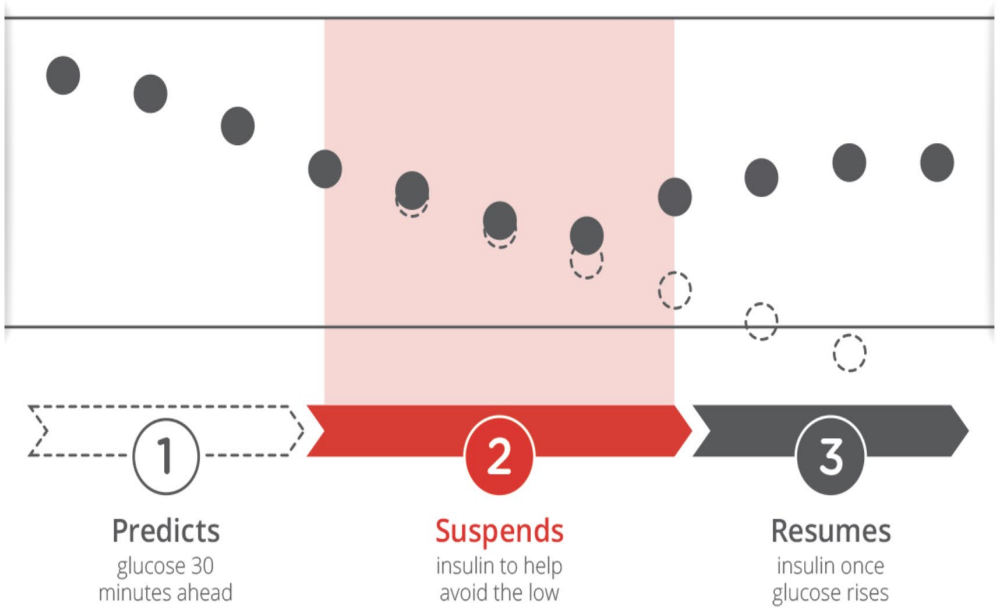


Tandem X2 with Basal IQ: Features

- Touch screen
- Rechargeable battery
- 300-unit resevoir
- Micro-delivery infusion
- Integrated Dexcom G6 CGM capability
- Software updates available

How does Basal-IQ Technology work?

The Basal-IQ feature helps reduce the frequency and duration of low-glucose events by predicting glucose levels 30 minutes ahead and suspending insulin if they are expected to drop below 80 mg/dL.



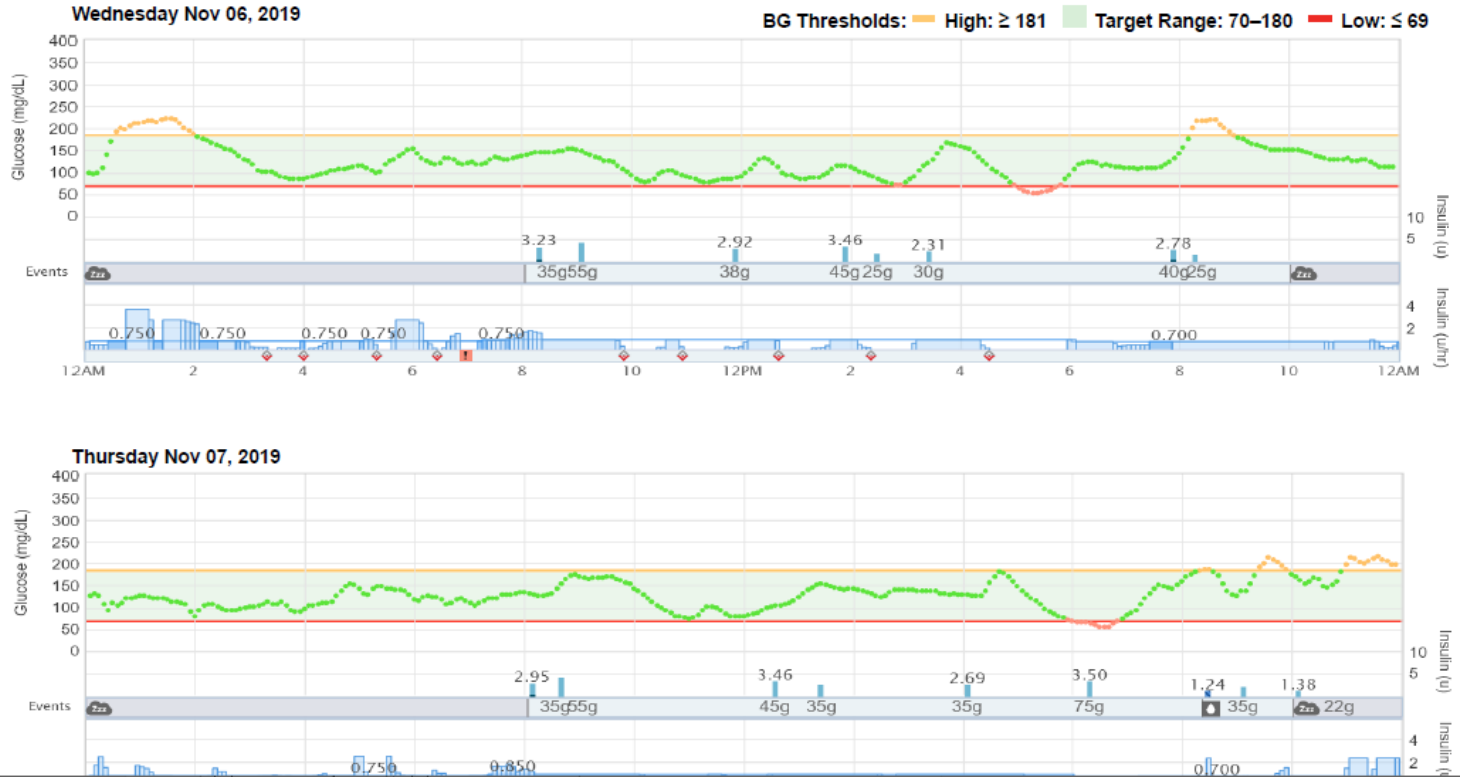
TANDEM™ DIABETES CARE

Joe Tandem

Born: Aug 28, 1984 Age: 35

Report Printed on November 15, 2019

Therapy Timeline | Wednesday Nov 06, 2019 - Tuesday Nov 12, 2019



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Best Insulin Pumps

Compare the Top 3 Insulin Pumps of 2019

MiniMed™ 670G

PROS

- Integrated Enlite 3 Continuous Glucose Monitor (CGM)
- Automatically adjusts basal insulin delivery based on data from CGM
- Bluetooth Bayer Contour Next Link Meter with remote bolusing.

CONS

- Enlite 3 CGM has accuracy issues
- Medtronic belt clip does not pivot so pump must be unclipped to view screen
- Screen is small
- Not a touch screen

Omnipod® DASH

PROS

- Only tubeless insulin pump
- Sleek touch screen personal diabetes manager
- Bluetooth Bayer Contour Next Meter
- Automatic insertion of cannula with the press of a button (great for toddlers)

CONS

- No integrated CGM
- Not capable of automatically adjusting insulin delivery or suspending delivery
- Holds only 200 units of insulin
- Must change pod every 3 days

t:slim X2™

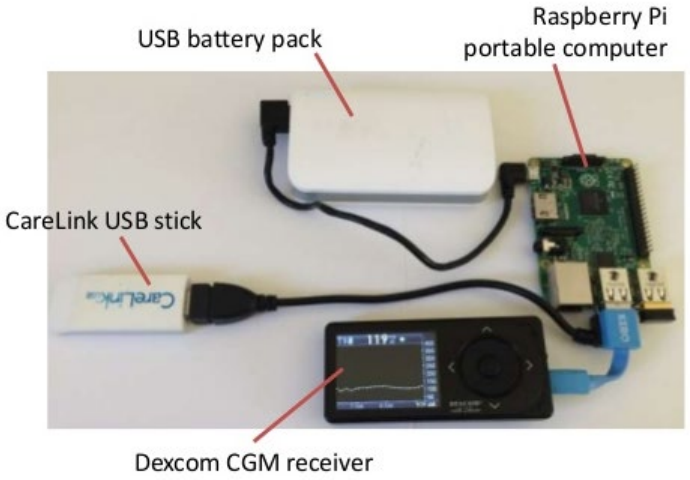
PROS

- Smallest insulin pump on the market
- Integrated Dexcom CGM is very accurate
- Automatically adjusts basal insulin based on data from CGM
- Pump software can be updated

CONS

- No link meter
- Tubing connector looks medical
- Rechargeable battery can be a con for some users

Open APS and Looping...



https://loopkit.github.io/loopdocs/faqs/FAQs/

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World Diabetes Day (WDD) was created in 1991 by IDF and the World Health Organization in response to growing concerns about the escalating health threat posed by diabetes. World Diabetes Day became an official United Nations Day in 2006 with the passage of United Nation Resolution 61/225. It is marked every year on **14 November**, the birthday of Sir Frederick Banting, who co-discovered insulin along with Charles Best in 1922.

WDD is the world's largest diabetes awareness campaign reaching a global audience of over 1 billion people in more than 160 countries. The campaign draws attention to issues of paramount importance to the diabetes world and keeps diabetes firmly in the public and political spotlight.


world diabetes day
14 November