HOW TO INITIATE AND INTENSIFY INSULIN THERAPY

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DISCLOSURES:

- Speaker/Consultant- Abbott, Bayer, Novo Nordisk, Xeris
- Advisor/Consultant- Eversense, Sanofi

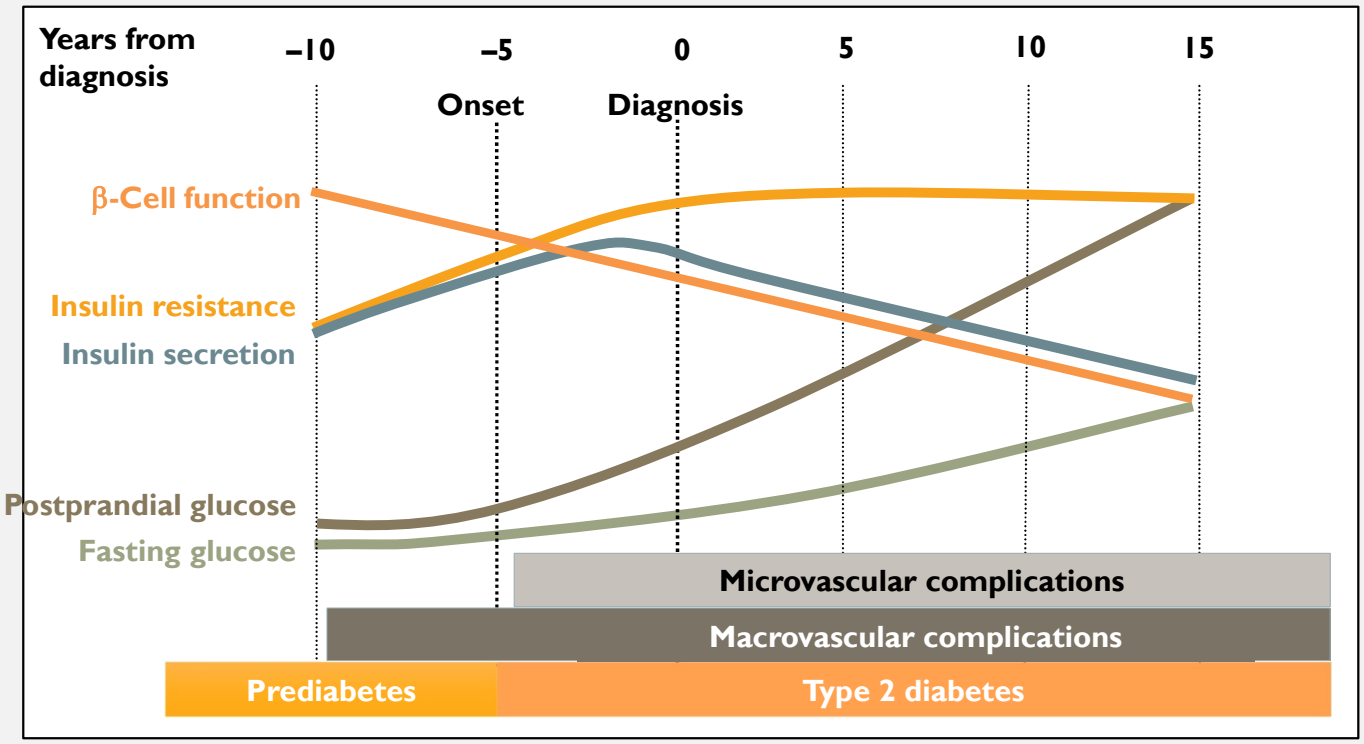
AT THE CONCLUSION OF THIS SESSION, PARTICIPANTS SHOULD BE ABLE TO:

- Discuss when ADA guidelines recommend utilizing insulin therapy in people with type 2 diabetes

- Learn how to initiate and titrate basal insulin, when patients with type 2 diabetes are not reaching glycemic targets with oral or noninsulin injectable medications

- Identify when intensification of insulin therapy is necessary and how to initiate and intensify prandial insulin

Natural History of Type 2 Diabetes



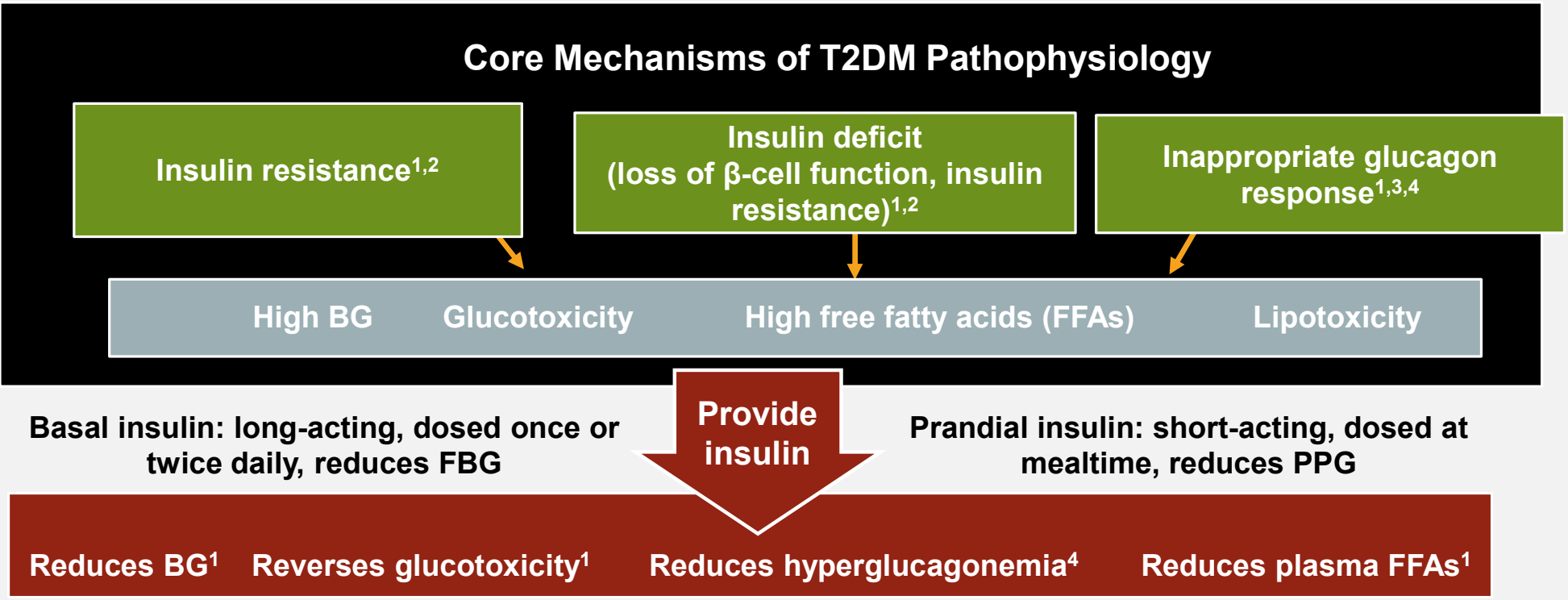
Beta Cell Function begins to decline 10 years prior to the diagnosis

50% Beta Cell Decline at time of diagnosis

Progressive decline 5% annually

Figure courtesy of CADRE. Accessed from www.aace.com, January 2019. Adapted from Holman RR. Diabetes Res Clin Pract 1998;40(Suppl.):S21–S25; Ramlo-Halsted BA, Edelman SV. Prim Care 1999;26:771 – 789; Nathan DM. N Engl J Med 2002;347:1342–1349; UK Prospective Diabetes Study Group. Diabetes 1995;44:1249–1258

PHYSIOLOGIC RATIONALE FOR INSULIN THERAPY



1. Hanefeld M, et al. *Diabetes Ther*. 2016;7:187-201; 2. Kahn SE. *Diabetologia*. 2003;46:3-19; 3. Mitrakou A, et al. *N Engl J Med*. 1992;326:22-29; 4. Kramer CK, et al. *J Clin Endocrinol Metab*. 2015;100:2987-2995.

PROGRESSIVE NATURE OF T2DM: NEED FOR INSULIN

In the UKPDS, **75%** of adults with newly diagnosed T2DM **needed insulin within 9 years**[1]

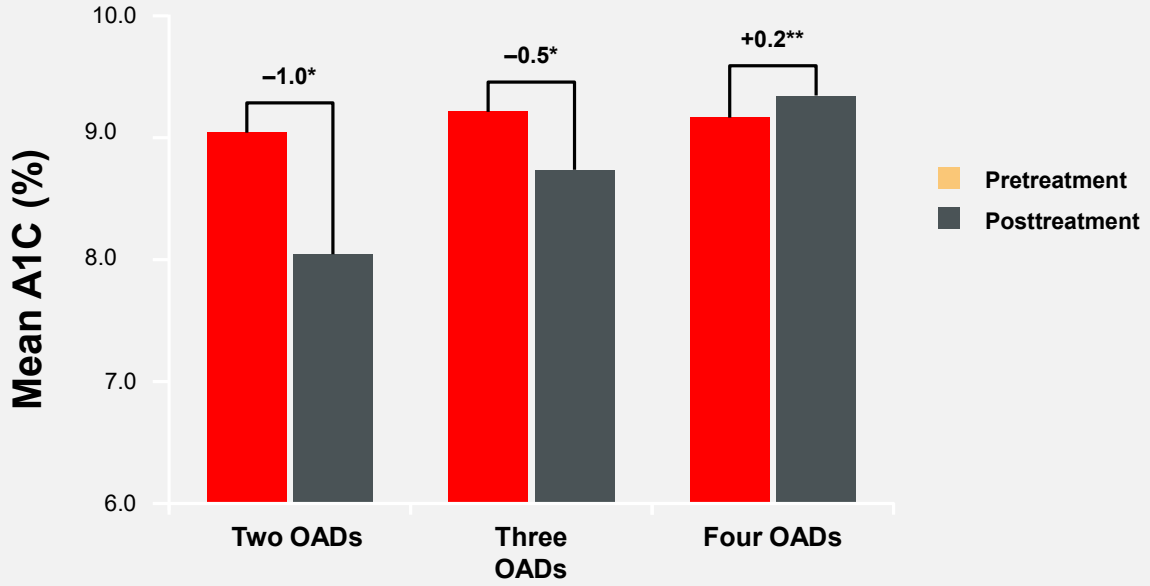
In the ORIGIN study, **11.4%** of adults with impaired fasting glucose, impaired glucose tolerance, or T2DM in the standard care arm **used insulin within 7 years**[2]

Even after **7 years with A1c >8%, insulin initiation is often postponed**, including patients **using 2 or 3 oral agents**[4]

ORIGIN = Outcome Reduction With Initial Glargine Intervention; TODAY = Treatment Options for Type 2 Diabetes in Adolescents and Youth; UKPDS = United Kingdom Prospective Diabetes Study.

1. Turner RC, et al. *JAMA*. 1999;281:2005-2012. 2. ORIGIN Trial Investigators, et al. *N Engl J Med*. 2012;367:319-328. 4. Khunti K, et al. *Diabetes Care*. 2013;36:3411-3417.

REDUCTION IN A1C WITH MULTIPLE OADS



***p<0.001.**

****p=0.54**

OADs = oral antidiabetic drugs.

Calvert MJ, et al. *Br J Gen Pract.* 2007;57:455-460.

CLINICAL INERTIA: FAILURE TO ADVANCE THERAPY WHEN REQUIRED

- 7208 courses of various Diabetes treatment in patients with T2DM
- At the time of insulin initiation, the average patient had:
  - 5 years with an A1c > 8%
  - 10 years with an A1c > 7%

Brown JB, et al. *Diabetes Care.* 2004;27:1535-1540.

BARRIERS TO USING INSULIN

- Health care providers
  - Lack of time and resources to supervise treatment
  - Lack of training, understanding, or experience
  - Fear of inducing hypoglycemia or concerns of insulin-related weight gain
  - Patients are resistant so HCPs are reluctant to start insulin
- Medical limitations of insulin treatment
  - Hypoglycemia
  - Weight gain

BARRIERS TO USING INSULIN

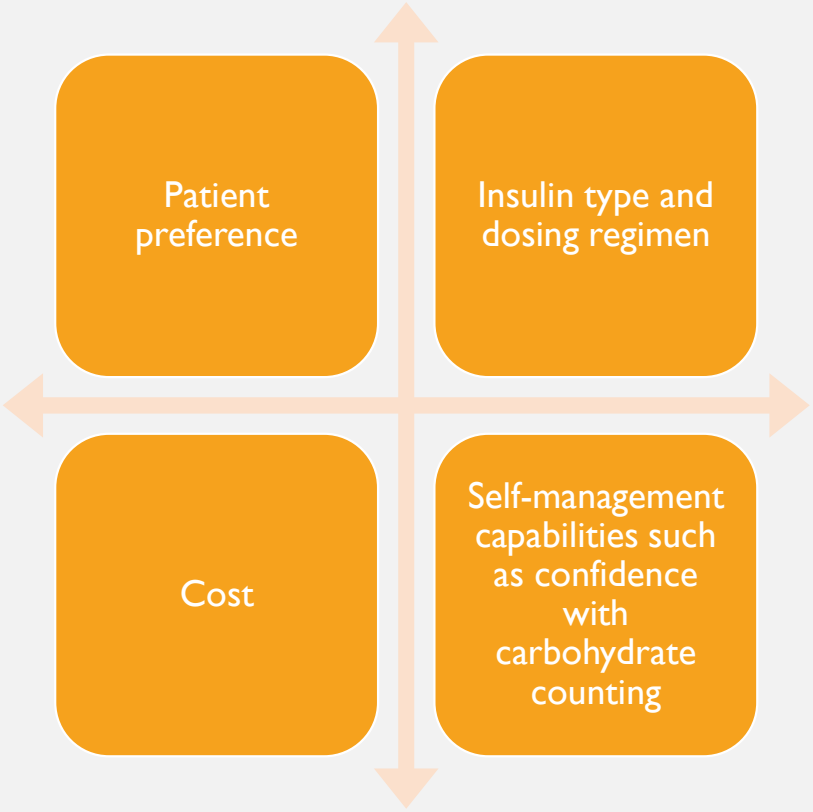
Patients

- Perceived significance of needing insulin
- Worse form of diabetes - “bad diabetes”
- Complications/Causal “myths”
  - Amputations, blindness, kidney failure are due to insulin
- Fear of injections, pain, hypoglycemia
- Concern of weight gain
- Complexity of regimens and insulin delivery devices
- Financial: newer physiologic insulin may be cost prohibitive for patients w or w/o health insurance (vs. human regular and NPH)

INSULIN DELIVERY OPTIONS AVAILABLE

Syringes	Insulin pens	Inhaled insulin	Disposable patch pump
Smart pens	Insulin pumps	Sensor-augmented pumps	Automated Insulin Delivery (AID) systems

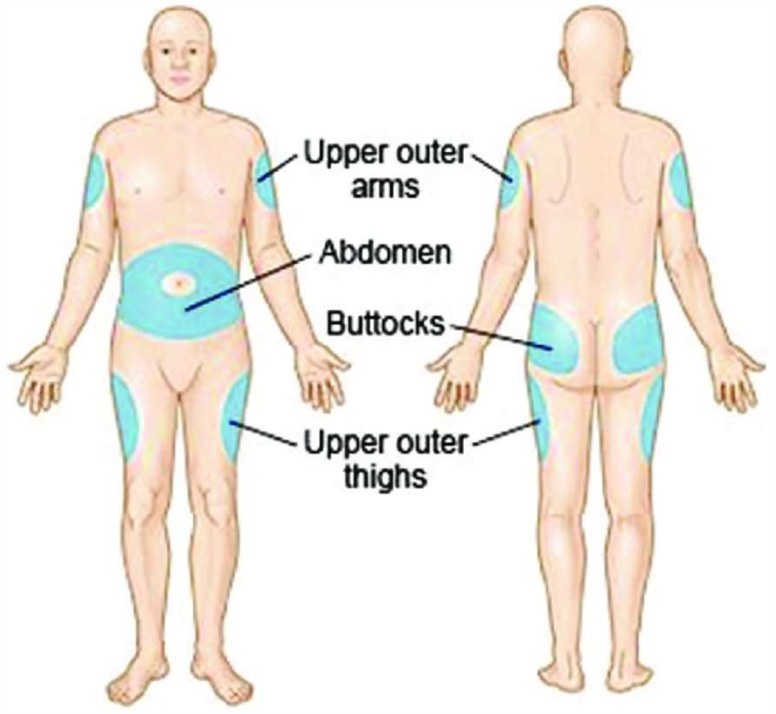
INDIVIDUAL INSULIN DELIVERY CONSIDERATIONS



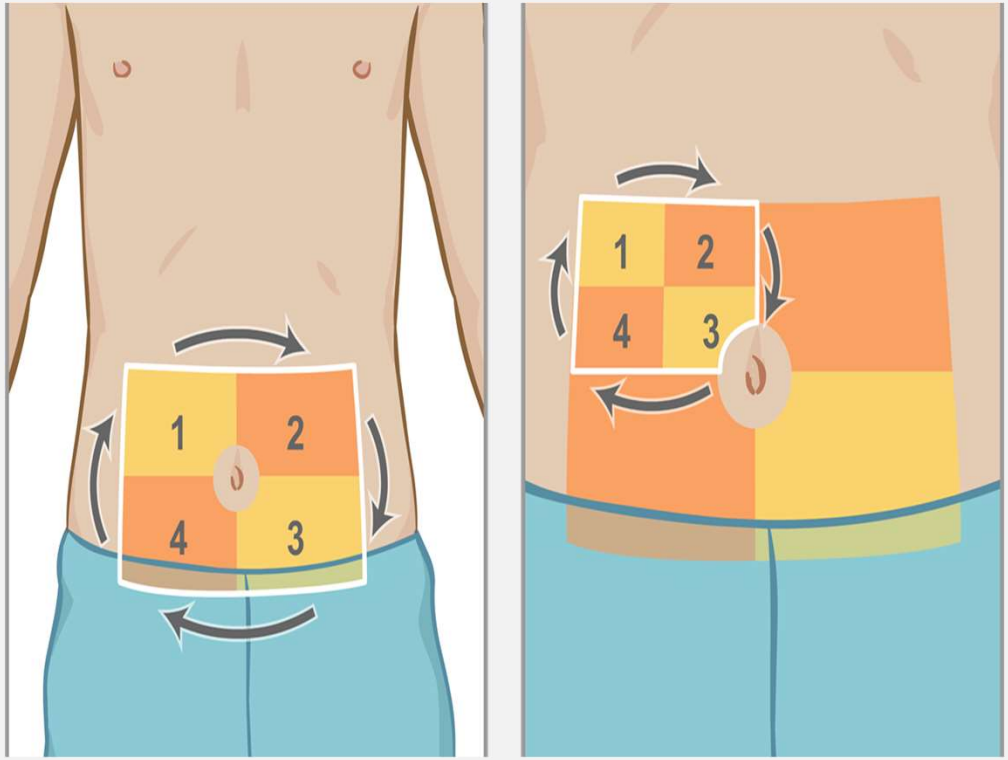
ElSayed NA et al 7. Diabetes Technology: *Standards of Care in Diabetes—2023*. *Diabetes Care* 1 January 2023; 46 (Supplement_1): S111–S127.

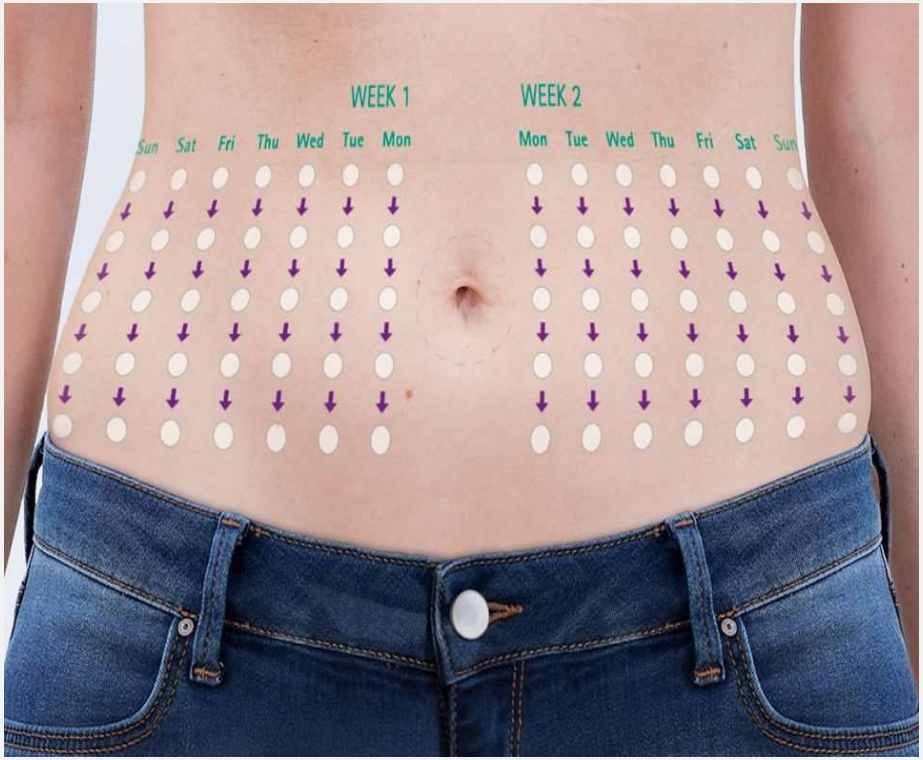
PROPER INSULIN INJECTION TECHNIQUE MATTERS

- Subcutaneous injection
- Injection sites- abdomen, thigh, buttock, upper arm
- Short needles (4 mm needles) are effective and well tolerated in all adults with diabetes
- Injection rotation to avoid lipohypertrophy
- Education on proper insulin injection technique should occur
- Regular assessments/examination of insulin injection sites should occur

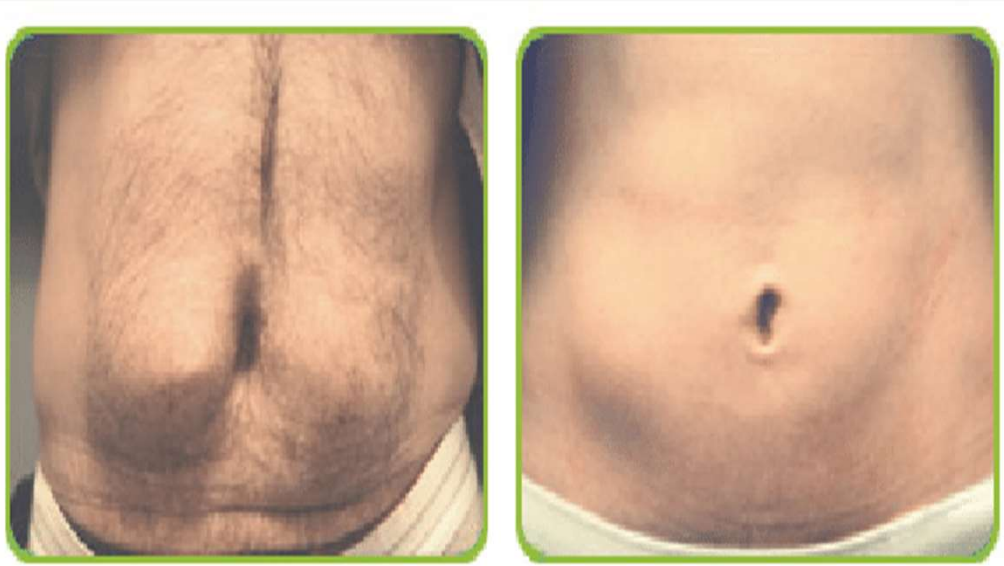


EXAMPLES OF SITE ROTATION





LIPOHYPERTROPHY



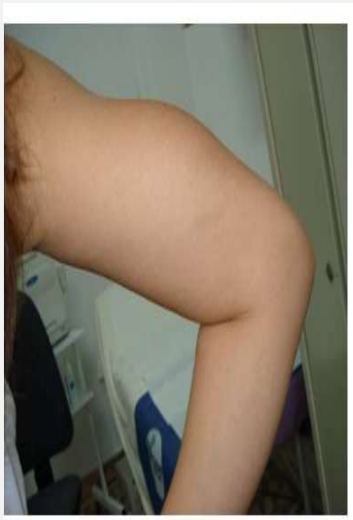


Figure 2a

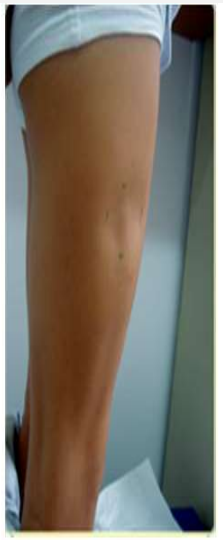


Figure 2b

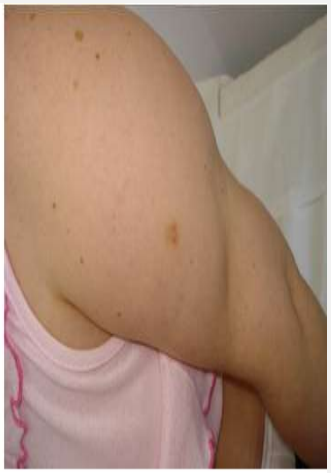


Figure 2c

USE OF GLUCOSE-LOWERING MEDICATIONS IN THE MANAGEMENT OF TYPE 2 DIABETES

HEALTHY LIFESTYLE BEHAVIORS; DIABETES SELF-MANAGEMENT EDUCATION AND SUPPORT (DSMES); SOCIAL DETERMINANTS OF HEALTH (SDOH)

TO AVOID THERAPEUTIC INERTIA REASSESS AND MODIFY TREATMENT REGULARLY (3–6 MONTHS)

Goal: Cardiorenal Risk Reduction in High-Risk Individuals with Type 2 Diabetes (in addition to comprehensive CV risk management)*

+ASCVD†

Defined differently across CVOTs but all included individuals with established CVD (e.g., MI, stroke, any revascularization procedure). Variably included: conditions such as transient ischemic attack, unstable angina, amputation, symptomatic or asymptomatic coronary artery disease.

+Indicators of high risk

While definitions vary, most comprise ≥55 years of age with two or more additional risk factors (including obesity, hypertension, smoking, dyslipidemia, or albuminuria)

+ASCVD/Indicators of High Risk

GLP-1 RA# with proven CVD benefit **EITHER/OR** SGLT2i§ with proven CVD benefit

If A1C above target

- For patients on a GLP-1 RA, consider adding SGLT2i with proven CVD benefit or vice versa
- TZD^

+HF

Current or prior symptoms of HF with documented HFrEF or HFpEF

+HF

SGLT2i§ with proven HF benefit in this population

+CKD

eGFR <60 mL/min per 1.73 m² OR albuminuria (ACR ≥3.0 mg/mmol [30 mg/g]). These measurements may vary over time; thus, a repeat measure is required to document CKD.

+CKD (on maximally tolerated dose of ACEi/ARB)

PREFERABLY

SGLT2i§ with primary evidence of reducing CKD progression

Use SGLT2i in people with an eGFR ≥20 mL/min per 1.73 m²; once initiated should be continued until initiation of dialysis or transplantation

OR

GLP-1 RA with proven CVD benefit if SGLT2i not tolerated or contraindicated

If A1C above target, for patients on SGLT2i, consider incorporating a GLP-1 RA or vice versa

If additional cardiorenal risk reduction or glycemic lowering needed

Goal: Achievement and Maintenance of Glycemic and Weight Management Goals

Glycemic Management: Choose approaches that provide the efficacy to achieve goals:

Metformin OR Agent(s) including COMBINATION therapy that provide adequate EFFICACY to achieve and maintain treatment goals

Prioritize avoidance of hypoglycemia in high-risk individuals

In general, higher efficacy approaches have greater likelihood of achieving glycemic goals

Efficacy for glucose lowering

Very High:
Dulaglutide (high dose), Semaglutide, Tirzepatide

Insulin

Combination Oral, Combination Injectable (GLP-1 RA/Insulin)

High:
GLP-1 RA (not listed above), Metformin, SGLT2i, Sulfonylurea, TZD

Intermediate:
DPP-4i

Achievement and Maintenance of Weight Management Goals:

Set individualized weight management goals

General lifestyle advice: medical nutrition therapy/eating patterns/ physical activity

Intensive evidence-based structured weight management program

Consider medication for weight loss

Consider metabolic surgery

When choosing glucose-lowering therapies:

Consider regimen with high-to-very-high dual glucose and weight efficacy

Efficacy for weight loss

Very High:
Semaglutide, Tirzepatide

High:
Dulaglutide, Liraglutide

Intermediate:
GLP-1 RA (not listed above), SGLT2i

Neutral:
DPP-4i, Metformin

If A1C above target

Identify barriers to goals:

- Consider DSMES referral to support self-efficacy in achievement of goals
- Consider technology (e.g., diagnostic CGM) to identify therapeutic gaps and tailor therapy
- Identify and address SDOH that impact achievement of goals

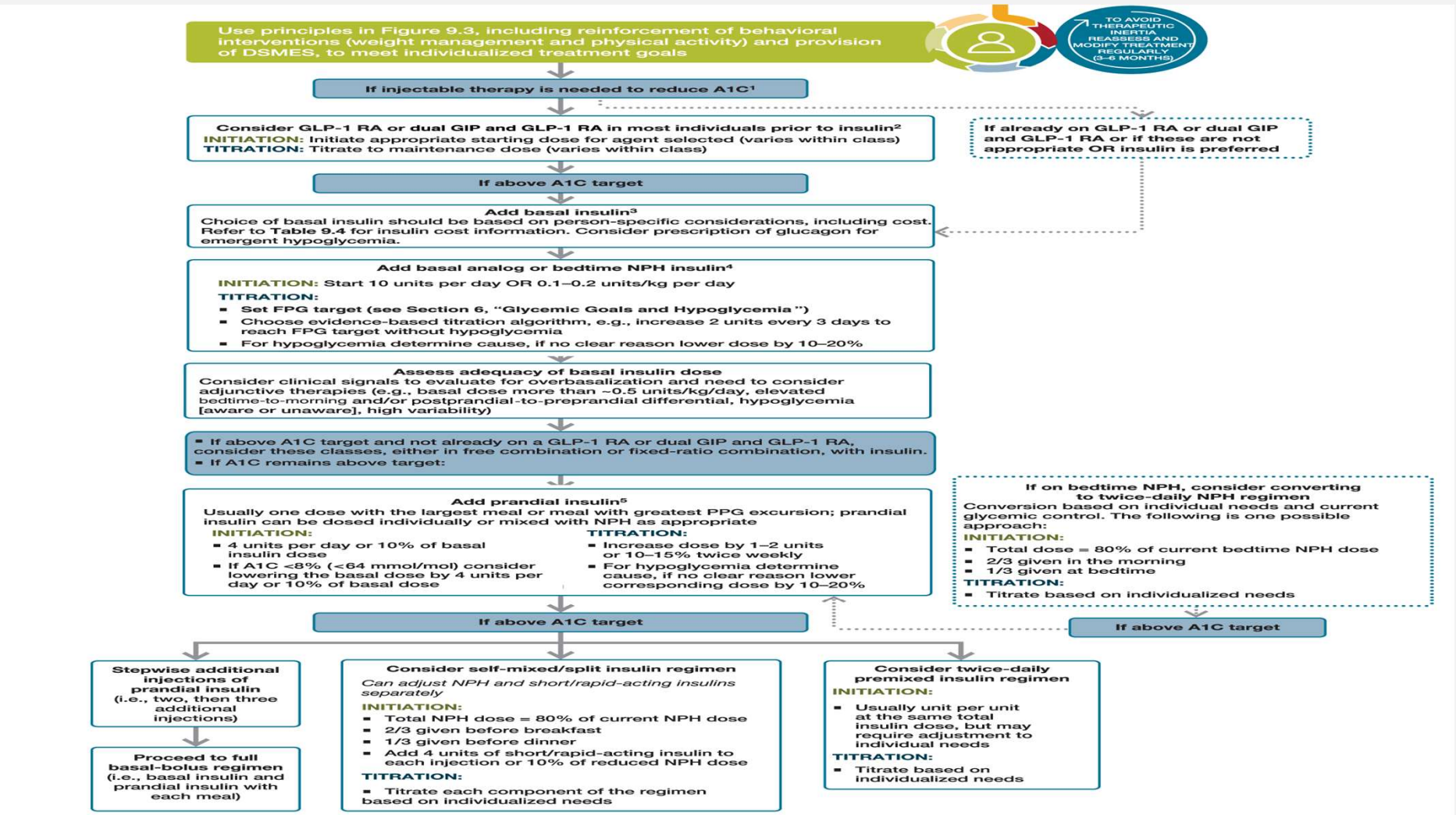
* In people with HF, CKD, established CVD, or multiple risk factors for CVD, the decision to use a GLP-1 RA or SGLT2i with proven benefit should be independent of background use of metformin; † A strong recommendation is warranted for people with CVD and a weaker recommendation for those with indicators of high CV risk. Moreover, a higher absolute risk reduction and thus lower numbers needed to treat are seen at higher levels of baseline risk and should be factored into the shared decision-making process. See text for details; ^ Low-dose TZD may be better tolerated and similarly effective; § For SGLT2i, CV/renal outcomes trials demonstrate their efficacy in reducing the risk of composite MACE, CV death, all-cause mortality, MI, HHF, and renal outcomes in individuals with T2D with established/high risk of CVD; # For GLP-1 RA, CVOTs demonstrate their efficacy in reducing composite MACE, CV death, all-cause mortality, MI, stroke, and renal endpoints in individuals with T2D with established/high risk of CVD.

ADA STANDARDS OF CARE RECOMMENDATIONS

- **9.22** In adults with type 2 diabetes, initiation of insulin should be considered regardless of background glucose-lowering therapy or disease stage if there is evidence of ongoing catabolism (e.g., unexpected weight loss), if symptoms of hyperglycemia are present, or when A1C or blood glucose levels are very high (i.e., A1C >10% [>86 mmol/mol] or blood glucose ≥300 mg/dL [≥16.7 mmol/L]). **E**

- **9.23** In adults with type 2 diabetes, a GLP-1 RA, including a dual glucose-dependent insulinotropic polypeptide (GIP) and GLP-1 RA, is preferred to insulin. **A**

- **9.24** If insulin is used, combination therapy with a GLP-1 RA, including a dual GIP and GLP-1 RA, is recommended for greater glycemic effectiveness as well as beneficial effects on weight and hypoglycemia risk for adults with type 2 diabetes. Insulin dosing should be reassessed upon addition or dose escalation of a GLP-1 RA or dual GIP and GLP-1 RA. **A**



1. Consider insulin as the first injectable if evidence of ongoing catabolism is present, symptoms of hyperglycemia are present, when A1C or blood glucose levels are very high (i.e., A1C >10% [>86 mmol/mol] or blood glucose ≥300 mg/dL [≥16.7 mmol/L]), or when a diagnosis of type 1 diabetes is a possibility.
2. When selecting GLP-1 RAs, consider individual preference, A1C lowering, weight-lowering effect, or frequency of injection. If CVO is present, consider GLP-1 RA with proven CVO benefit. Oral or injectable GLP-1 RAs are appropriate.
3. For people on GLP-1 RA and basal insulin combination, consider use of a fixed-ratio combination product (IDegLira or iGlarLixi).
4. Consider switching from evening NPH to a basal analog if the individual develops hypoglycemia and/or frequently forgets to administer NPH in the evening and would be better managed with an A.M. dose of a long-acting basal insulin.
5. If adding prandial insulin to NPH, consider initiation of a self-mixed or premixed insulin plan to decrease the number of injections required.

BASAL INSULIN

Basal Insulins Used in the U.S.

Name		Form	Time of Action* (h)			Comments
Generic	Brand		Onset	Peak	Duration	
Intermediate-acting ('Basal')						
NPH	Humulin Novolin Relion	Human	1-2	4-12	10-16	Increased risk of hypoglycemia when compared to analog basal insulin. Pregnancy (category B) - safe.
Long-acting ('Basal')						
Detemir U-100	Levemir (d/c)	Analog	1-2	Relatively peakless	24	Expect that a higher daily dose of glargine U-300 than glargine U-100 will be needed. **(Glargine - C; Degludec - C; Detemir - B)**
Glargine U-100	Lantus, Basaglar Semglee	Analog	1-2	Relatively peakless	24	
Glargine U-300	Toujeo	Analog	6	Relatively peakless	≥24	
Degludec U-100, U-200	Tresiba	Analog	1-2	Relatively peakless	≥42	

*Dose dependent (except glargine U-300, degludec)

Lepore M, et al. *Diabetes*. 2000;49:2142-2148. Plank J, et al. *Diabetes Care*. 2005;28:1107-1112. Heise T, et al. *Diabetes*. 2004;53:1614-1620. Porcellati F, et al. *Diabetes Care*. 2007;30;2447-2452.
Porcellati F, et al. Diabetes Care. 2007;30:1261-1263. Hirsch IB. N Engl J Med. 2005;352(2):174–183. Meneghini L, et al. Diabetes Obes Metab. 2007;9(6):902–913. Lantus [package insert] Bridgewater, NJ: sanofi-aventis US LLC; May 2019. Basaglar [package insert]. Indianapolis, IN: Eli Lilly & Co.; January 2019. Levemir [package insert]. Plainsboro, NJ: Novo Nordisk US; January 2019. Toujeo [package insert]. Bridgewater, NJ: sanofi-aventis US LLC; March 2019. Tresiba [package insert]. Plainsboro, NJ: Novo Nordisk Inc.; November 2018. Nasrallah S, et al. Clin Med Insights Endocrinol Diabetes. 2012;5;31-37.

DOSING FLEXIBILITY WITH BASAL INSULINS

Insulin	Dosing Instructions
NPH	• Once or twice daily
Detemir (has been discontinued)	• Once or twice daily • Once daily with dinner or at bedtime • 12 h apart for twice daily
Glargine and U-300 glargine	• Once daily at any time, but the same time each day
Degludec	• Once daily at any time • Missed dose when remembered, with at least 8 h between doses

Drugs@FDA. www.accessdata.fda.gov/scripts/cder/daf

HYPOGLYCEMIA RISK DIFFERS AMONG BASAL INSULINS

DEGLADEC:

- Overall hypoglycemia ↓ **30%**[2]
- Nocturnal ↓ **42%**[2]
- Severe, in patients at high CV risk ↓ **40%**[3]

U-300 GLARGINE:

- Clinically significant nocturnal ↓ **25%**[4]
- Risk of confirmed or severe events[5]
  - ↓ **15%** at night
  - ↓ **6%** during the day

Lower risk* with DET *or* U-100 GLAR vs NPH[1]

Lower risk with DEG *or* U-300 GLAR vs U-100 GLAR[1]

*Lower risk of symptomatic and nocturnal hypoglycemia.

1. American Diabetes Association. Diabetes Care. 2019;42(suppl 1):S1-S193; 2. Wysham C, et al. JAMA. 2017;318:45-56; 3. Marso SP, et al. N Engl J Med. 2017;377:723-732; 4. Diez-Fernandez A, et al. Acta Diabetol. 2019;56:355-364; 5. Ritzel R, et al. Diabetes Obes Metab. 2018;20:541-548.

ADA'S RECOMMENDATION TO INITIATION OF BASAL INSULIN

Add basal analog or bedtime NPH NPH insulin

Start 10 units a day **or** 0.1-0.2 units/kg a day

*Choice of basal insulin should be based on person-specific considerations, including cost. Refer to **Table 9.4** for insulin cost information. Consider a prescription of glucagon for emergent hypoglycemia

American Diabetes Association. 9. Pharmacologic approaches to glycemic treatment: Standards of Medical Care in Diabetes 2024. Diabetes Care January 2024;47(Suppl. 1):S158–S178

EXAMPLE OF CALCULATING BASAL INSULIN

- 53 year old patient who weighs 253 lbs is ready to start basal insulin
- **10 units** initiation dose

- Or calculate weight-based dose

  253 divided by 2.2= 115 kg

  115 kg x 0.2 units= **23 units**

  Base your starting dose on individual factors per patient

ADA'S RECOMMENDATIONS TO TITRATING BASAL INSULIN

- **Titrate or Adjust**

- **Set Fasting Plasma Glucose Target**
- **(ADA recommends 80 to 130 mg/dl)**

- **Choose evidence-based titration algorithm (e.g., increase 2 units every 3 days) to reach FPG target without hypoglycemia**

- **For hypoglycemia determine cause, if no clear reason lower dose by 10-20%**

- **Recommend to only adjust ultra long-acting insulins weekly or no more than every 3 to 4 days**

American Diabetes Association. 9. Pharmacologic approaches to glycemic treatment: Standards of Medical Care in Diabetes 2024. Diabetes Care January 2024;47(Suppl. 1):S158–S178

ADA STANDARDS OF CARE RECOMMENDATIONS

- **9.27** Monitor for signs of overbasalization during insulin therapy, such as basal dose exceeding ~0.5 units/kg/day, significant bedtime-to-morning or postprandial-to-preprandial glucose differential, occurrences of hypoglycemia (aware or unaware), and high glycemic variability. When overbasalization is suspected, a thorough reevaluation should occur promptly to further tailor therapy to the individual's needs. **E**

- **9.26** To minimize the risk of hypoglycemia and treatment burden when starting insulin therapy in adults with type 2 diabetes, reassess the need for and/or dose of glucose-lowering agents with higher hypoglycemia risk (i.e., sulfonylureas and meglitinides). **A**

American Diabetes Association. 9. Pharmacologic approaches to glycemic treatment: Standards of Medical Care in Diabetes 2024. Diabetes Care January 2024;47(Suppl. 1):S158–S178

ASSESS ADEQUACY OF BASAL INSULIN DOSE

- Consider clinical signals to evaluate **overbasalization** and the need to consider adjunctive therapies:
  - Basal dose > 0.5units/kg/day
  - Elevated bedtime-morning and/or post-preprandial differential
  - Hypoglycemia (aware or unaware)
  - High variability

American Diabetes Association. 9. Pharmacologic approaches to glycemic treatment: Standards of Medical Care in Diabetes 2024. Diabetes Care January 2024;47(Suppl. 1):S158–S178

GUIDANCE REGARDING USE OF OTHER GLUCOSE-LOWERING AGENTS WHEN INITIATING BASAL INSULIN

Continue	• **Metformin[1,2]** • **GLP-1 RA, DPP-4 inhibitor[1,2]** • **SGLT2 inhibitor (to prevent diabetic ketoacidosis, do not down titrate insulin overaggressively)[1,2]**
Reduce dose or discontinue	• **Sulfonylurea (to prevent hypoglycemia)[1,2]** • **Thiazolidinedione (to prevent edema or heart failure)[1,2]**

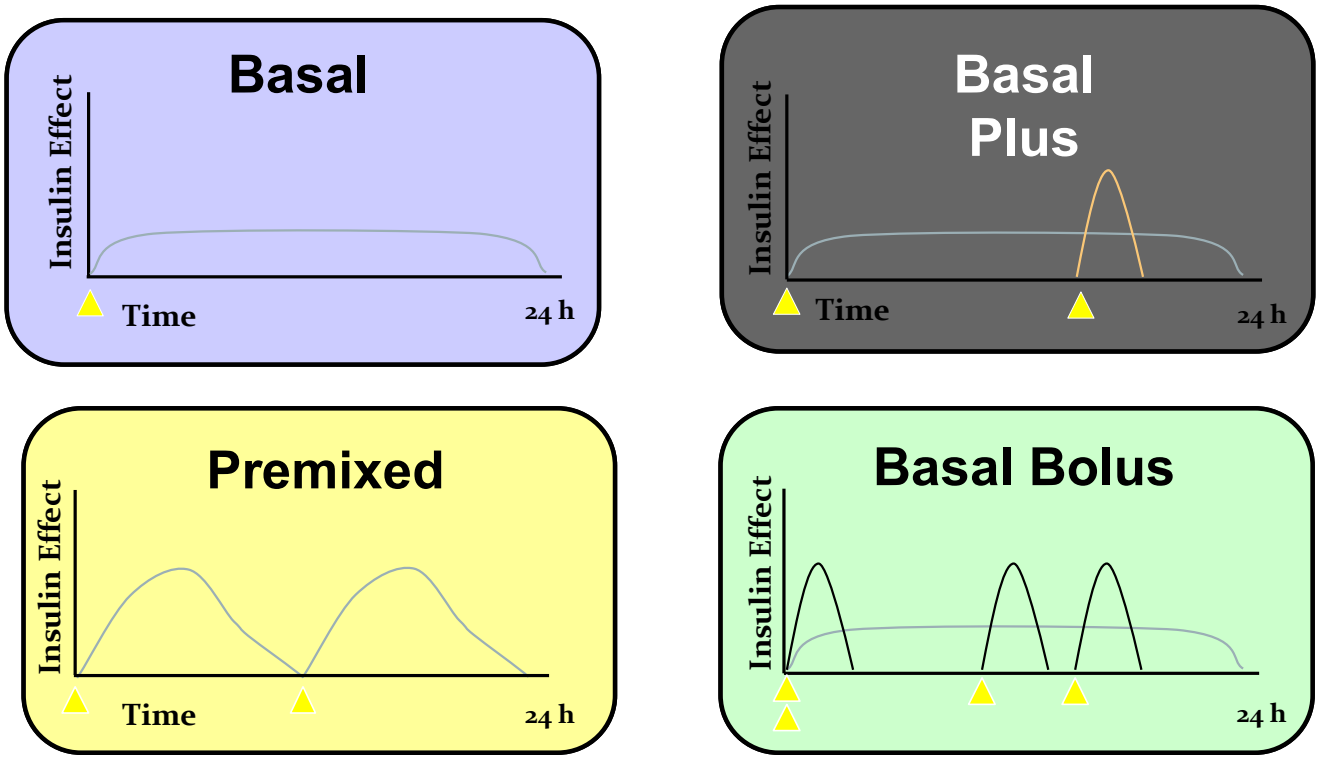
Consider discontinuation of other agents on an individual basis to avoid unnecessarily complex* or costly regimens[2]

4-drug combinations.

1. Davies MJ, et al. *Diabetes Care*. 2018;41:2669-2701; 2. American Diabetes Association. *Diabetes Care*. 2019;42(suppl 1):S1-S193;
3. Drugs@FDA. www.accessdata.fda.gov/scripts/cder/daf.

INTENSIFYING INSULIN THERAPY

COMMON INSULIN REGIMENS



- Del Prato S, et al. Diabetes Technol Ther. 2012;14:175-182.
- American Diabetes Association. In: Practical Insulin: A Handbook for Prescribing Providers. 3rd ed. 2011:1-68.

THE BASAL/BOLUS INSULIN CONCEPT

Basal insulin:

The goal of basal insulin is to suppress hepatic glucose production and limit fasting hyperglycemia. Helps to improve both overnight and between meals control.

When using replacement therapy, **~50 percent of the total daily insulin dose is given as basal.**

Bolus insulin (prandial/mealtime):

The goal of bolus insulin is to cover the carbohydrate in meals and to limit postprandial hyperglycemia. Ideally, blood glucose should rise only 30-60 mg/dL from pre- to post-meal.

When using replacement therapy, **~50 percent of daily needs are provided as bolus: distributed between the meals.**

Petznick A. Insulin management of type 2 diabetes mellitus. Am Fam Physician. 2011 Jul 15;84(2):183-90

Prandial Insulins Used in the U.S.

Name		Form	Time of Action* (h)			Meal Timing (min)
Generic	Brand		Onset	Peak	Duration	
Rapid-acting ('Bolus' or 'Prandial')						
Aspart	Fiasp	Analog	0.25-0.3	1.5-2	5-7	0 to +20
Lispro	Lyumjev	Analog	15-17	57min	5-7	0 to +20
Aspart	Novolog	Analog	< 0.25	1-3	3-5	-5 to -10
Glulisine	Apidra	Analog	< 0.25	0.7-3	3-5	-15 to +20
Lispro	Humalog (U-100, U-200) Admelog (U-100)	Analog	< 0.25	0.5-1.5	3-6	-15 to immediately after
Insulin Inhalation	Afrezza	Human	< 0.25	0.5-1.5	2.7	0
Short-acting ('Bolus' or 'Prandial')						
Regular	Humulin R Novolin R	Human	0.25-1.25	1.5-3.5	8	-30

Fiasp [package insert]. Plainsboro, NJ: Novo Nordisk Inc.; September 2018. Novolog [package insert]. Plainsboro, NJ: Novo Nordisk Inc.; December 2018. Apidra [package insert]. Bridgewater, NJ: sanofi-aventis US, LLC: January 2019. Humalog [package insert]. Indianapolis, IN: Eli Lilly; March 2019. Admelog [package insert]. sanofi-aventis US, LLC; December 2018. Afrezza [package insert]. Danbury, CT: MannKind Corp.; October 2018. Humulin R [package insert]. Indianapolis, IN: Eli Lilly; November 2018. Novolin R [package insert]. Plainsboro, NJ: Novo Nordisk Inc: June 2018.

INITIATION OF PRANDIAL INSULIN

- Initiation:
  - 4 units/day or 10% of basal dose
  - One dose with the largest meal or meal with the greatest PPG excursion
  - Prandial insulin can be **dosed individually** or **mixed with NPH as appropriate**
  - If A1C is <8% (64 mmol/mol), consider decreasing the basal dose by 4 units a day or 10% of basal dose

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EXAMPLE OF ADDING PRANDIAL

A1C is > 8% and patient is on 36 units of basal insulin:

36 units basal at bedtime

4 units prandial with largest meal of day (most cases evening meal)

A1C is <8% and patient is on 36 units of basal insulin:

32 units of basal at bedtime

4 units of prandial with largest meal of day (most cases evening meal)

TITRATION OF PRANDIAL INSULIN

Titration:

- Increase dose by 1–2 units or 10–15% twice weekly
- Test plasma glucose levels using SMBG just before and 2 hours after largest meal

Signs or symptoms of hypoglycemia:

- Determine and address cause
- If no clear reason lower corresponding dose by 10–20%

American Diabetes Association. 9. Pharmacologic approaches to glycemic treatment: Standards of Medical Care in Diabetes 2024. Diabetes Care January 2024;47(Suppl. 1):S158–S178

PRANDIAL INSULIN IN A STEPWISE APPROACH

Stepwise approach:

Add prandial insulin to a second meal based on post prandial readings

- Individualized to the patient based on SMBG or CGM
- May be breakfast or lunch
- Start 4 units and titrate as previously demonstrated

May need to add to third meal after 3 months if necessary to full basal/bolus

American Diabetes Association. 9. Pharmacologic approaches to glycemic treatment: Standards of Medical Care in Diabetes 2024. Diabetes Care January 2024;47(Suppl. 1):S158–S178
American Diabetes Association. Diabetes Care 2020;43(Suppl. 1): S98–S110

TRADITIONAL "SLIDING SCALE"

Pre-Meal BG (mg/dl)	Insulin Dose (units)
Less than 151	0
151-200	2
201-250	4
251-300	6
301-350	8
351-400	10

An arbitrary insulin dosing algorithm based only on pre-meal blood glucose values; doesn't consider patients' weight, ISF, ICR, or carbs to be consumed.

PROBLEMS WITH "TRADITIONAL SLIDING SCALE"

Sliding scale not specific to patient needs

- Not flexible for carbohydrate in meals
- Some meals may need more insulin
- No adjustment for portion size, lower BG, Higher BG, life in general

No meal insulin if less than 100mg/dl??

Use of correction insulin??

CARB COUNTING/ INSULIN SENSITIVITY FACTOR

- Can be calculated by Total Daily Insulin Delivery
- Can be used for individuals who want more exact dosing of insulin
- Carb Ratio: 450/TDD Example: 450/50= 1 unit for 9 grams/carbs
- Insulin Sensitivity Factor: 1799/TDD Example: 1700/50= 34 mg/dl

SELF MIXED/SPLIT INSULIN REGIMEN

SELF MIXED/SPLIT INSULIN REGIMEN

- Can adjust NPH insulin and short/rapid acting insulins separately

INITIATION

- Total NPH dose= 80% of current NPH dose
  - 2/3 given before breakfast
  - 1/3 given before dinner
- Add 4 units of short/rapid acting insulin to each injection or 10% of reduced NPH dose

TITRATION

Titrate each component of the regimen based on individualized needs

American Diabetes Association. 9. Pharmacologic approaches to glycemic treatment: Standards of Medical Care in Diabetes 2024. Diabetes Care January 2024;47(Suppl. 1):S158–S178

PRE-MIXED INSULIN REGIMEN

PRE-MIXED INSULIN: RAPID-ACTING + INTERMEDIATE-ACTING

Insulin	Onset	Peak	Duration
Lispro (Humalog) (25%), (50%) Aspart (Novolog) (30%)	~15 min	1-2 h	3-5 h
NPL, insulin lispro protamine (75%), (50%) NPA, insulin aspart protamine (70%)	2-3 h	4-10 h	10-16 h
Humalog 75/25, Humalog 50/50, Novolog 70/30			

TWICE DAILY PREMIX INSULIN REGIMEN

Initiation:

- Usually unit to unit at the same total insulin dose, but may require adjustment to individual needs

  Example: 50 units of basal insulin

  Change to twice daily premix to 25 units twice daily

Titration: Titrate based on individualized needs

Fasting glucose in AM elevated

Increase evening dose 2 units every 3 days

If pre dinner glucose is elevated

Increase morning dose by 2 units every 3 days

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AVAILABLE GLUCAGON FORMULATIONS

Intranasal Powder Device	Autoinjector pen (a prefilled syringe also available)	Autoinjector prefilled pen
Baqsimi® (glucagon)	Zegalogue® (dasiglucagon)	Gvoke® (glucagon)
>4 years old	>6 years old	>2 years old
3 mg dose 2nd dose can be administered after 15 minutes	0.6 mg 2nd dose can be administered after 15 minutes	Age >12 years old: 1 mg Age <12 years old and <45 kg: 0.5 mg Age <12 years old and >45 kg: 1 mg 2nd dose can be administered after 15 minutes

NEWER GLUCAGON FORMULATIONS

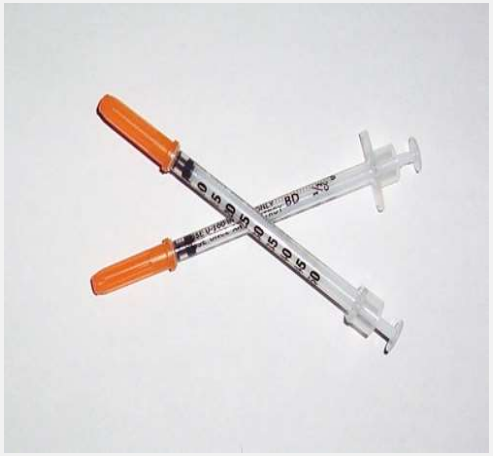
- Intra Nasal Powder Device
- >4 years old
- 3 mg dose. 2nd dose can be administered after 15 minutes

Gvoke

- Auto Injector prefilled pen
- >2 years old
- Age >12 years old 1 mg. Age <12 if weighs <45 KG 0.5mg, >45 KG 1.0 mg. 2nd dose can be administered after 15 minutes

Autoinjector pen (a prefilled syringe also available)
Zegalogue® (dasiglucagon)
>6 years old
0.6 mg 2nd dose can be administered after 15 minutes

INSULIN DELIVERY OPTIONS



Syringes

Traditional Insulin Pens

Afrezza inhaled insulin

SMART PENS AND SMART BUTTONS

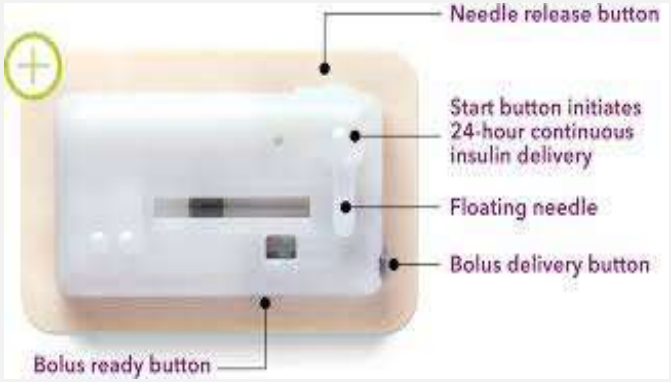
InPen

Tempo Smart Pen/Button

BigFoot Diabetes Unity

NovoPen 6 Novopen Echo Plus

DISPOSABLE PATCH INSULIN DELIVERY DEVICES



V Go Insulin Delivery
Basal & Bolus Delivery

CeQur Simplicity
Bolus insulin Delivery

AUTOMATED INSULIN DELIVERY SYSTEMS

SUMMARY

- Insulin therapy is often required in persons with diabetes due to the progression of the disease
- GLP1 or GLP1/GIP is the first preferred injection
- Basal insulin should be initiated if glycemic targets have not been met with non-insulin medications
- Intensifying insulin with prandial insulin in a step-wise approach is recommended
- There are multiple insulin delivery devices available to meet person's preferences