International Diabetes Center

Clinician CGM Guided Management (CCGM) of Patients with T2D on Insulin

HealthPartners® Institute

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This booklet should not be interpreted as including all available and proper methods of diabetes care. The decision regarding any specific treatment modality or dosing titration/advancement must be made by the healthcare professional with consideration of the particular circumstances presented by the patient and needs and resources particular to the community or institution.

The guidelines in this booklet were developed based on current principles of diabetes management and evidence-based guidelines:

1. American Diabetes Association Professional Practice Committee. Standards of Care in Diabetes – 2024. Diabetes Care. 1 January 2024. 47 (suppl 1).

2. Battelino T, et al. Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range. Diabetes Care. 1 August 2019; 42(8):1593-1603.

3. Grunberger G, et al. American Association of Clinical Endocrinology Clinical Practice Guideline: The Use of Advanced Technology in the Management of Persons with Diabetes Mellitus. Endocrine Practice. 2021;27:505-537.

Contents

Preparing for Success: Medication Optimization PRIOR to Using the CCGM Tables

Step 1:
Does patient have established ASCVD, CHF, or CKD (Indications for GLP-1RA or SGLT2i therapy)?

If YES, In addition to insulin-based management:

If NO, Move to Step 2.

If ASCVD (or high risk for ASCVD) suggest starting or intensifying GLP1-RA or SGLT2i therapy.
Then Move to Step 2
When starting or intensifying GLP-1 RA or GIP/GLP-1 RA therapy decrease total daily dose (TDD) of insulin by 20% if TIR is 50% or more; maintain insulin dose if TIR <50%. See note below on starting an SGLT2i.

OR

If CHF or CKD suggest SGLT2i therapy (see note on starting an SGLT2i).
Then Move to Step 2
Note: When Starting an SGLT2i in a patient using basal-bolus insulin therapy, suggest referral to diabetes education or endocrinology to educate on steps to minimize risk of euglycemic DKA (they may consider ketone monitoring in patients likely to be insulin-deficient, such as those who are non-obese, or have a long-duration of diabetes).

Step 2:
Is patient on sulfonylurea therapy in addition to insulin therapy?

If NO, Move to Step 3.

If on basal-bolus insulin or premixed insulin, RECOMMEND stopping sulfonylurea to reduce risk of hypoglycemia.

If on basal insulin, CONSIDER stopping sulfonylurea to reduce risk of hypoglycemia.
- **If the current TBR is ≥ 3%,** RECOMMEND stopping sulfonylurea.

Move to Step 3.

Step 3:
Was there a change in therapy based on Step 1 or Step 2?

If NO, Move to Clinician CGM Guided Management table for basal, basal-bolus, or premixed insulin users for therapy adjustment.

If YES, wait 2-4 weeks for the impact of therapy change, then Move to Clinician CGM Guided Management table for the appropriate insulin regimen.

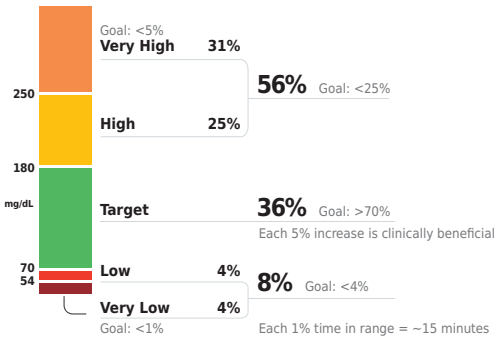
Example of Ambulatory Glucose Profile (AGP) Report for CGM

See enlargement on next page.

AGP Report: Continuous Glucose Monitoring

Time in Ranges

Goals for Type 1 and Type 2 Diabetes



Test Patient DOB:

14 Days:

Time CGM Active: 94.6%

Glucose Metrics

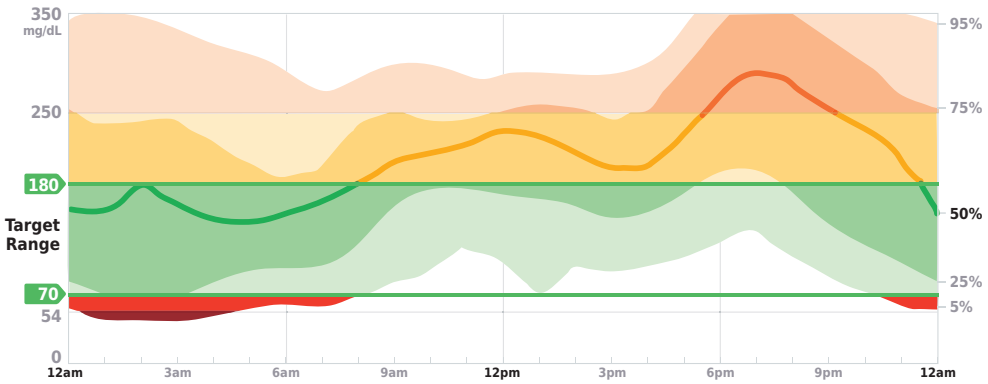
Average Glucose ..... **201 mg/dL**
Goal: <154 mg/dL

Glucose Management Indicator (GMI) **8.1%**
Goal: <7%

Glucose Variability **45.2%**
Defined as percent coefficient of variation
Goal: ≤36%

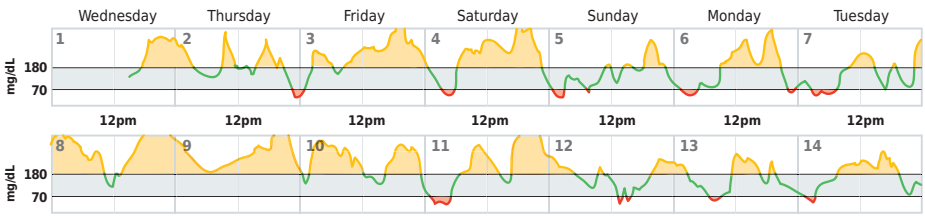
Ambulatory Glucose Profile (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if they occurred in a single day.



Daily Glucose Profiles

Each daily profile represents a midnight-to-midnight period.



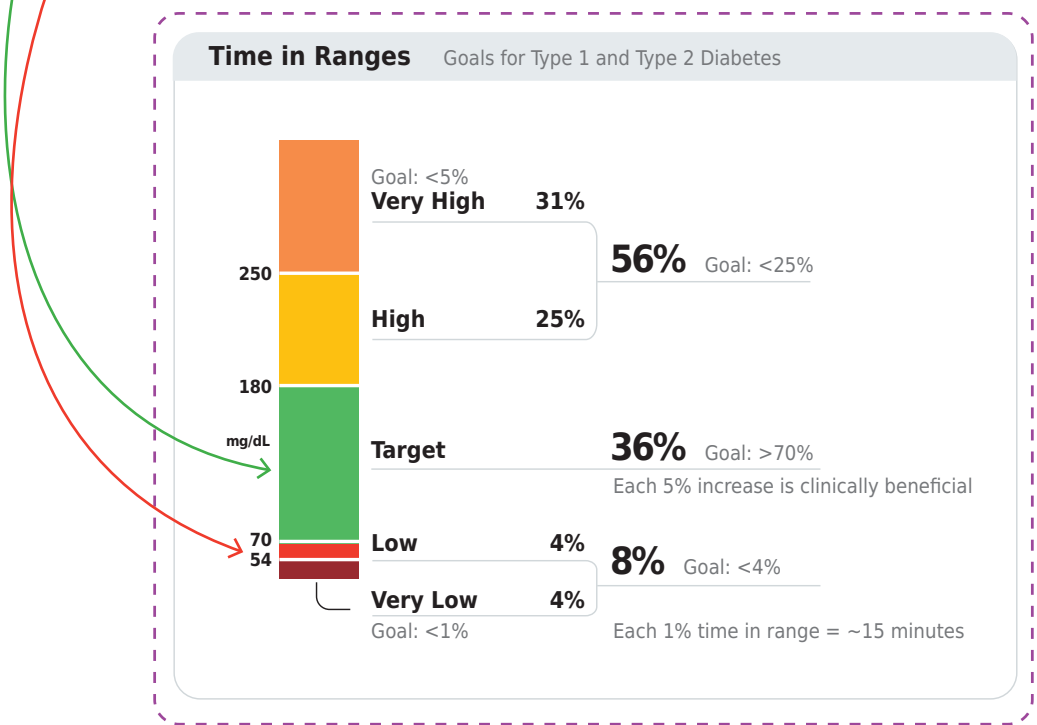
Finding Your Time in Range/Time Below Range Category

A. Determine the insulin regimen (**basal** or **basal-bolus** or **premixed insulin**).

B. If patient is on **basal insulin**, CONSIDER stopping sulfonylurea to reduce the risk of hypoglycemia. If patient is on **basal-bolus insulin** or **premixed insulin**, RECOMMEND stopping sulfonylurea to reduce the risk of hypoglycemia.

C. Find the % time in range (**target range**) and % time below range (**low and very low**) from the AGP Report (see example below).
- Is time in range (TIR) [70-180 mg/dL] >70%?
  Example shows 36%
- Is time below range (TBR) [< 70 mg/dL] <3%?
  Example shows 8%

D. Find TIR/TBR category in the table for the appropriate insulin regimen. See page 4 for **Basal insulin,** page 6 for **Basal and Bolus insulin,** and page 8 for **Premixed Insulin.**



Clinician CGM Guided Management: For Patients on **Basal Insulin**

	TIR/TBR Category	Action
1	**Time in range >70%** and **Time below range <3%**	Continue regimen
2	**Time in range >70%** and **Time below range ≥3%**	Address hypoglycemia
3	**Time in range ≤70%** and **Time below range <3%**	Address hyperglycemia
4	**Time in range ≤70%** and **Time below range ≥3%**	Address hypoglycemia today; also refer to diabetes education or endocrinology

	Medication Adjustment Considerations
	Continue to optimize current therapy; reinforce lifestyle changes and taking medications as prescribed; consider increasing basal insulin by 5% if no low glucose on AGP curve* **Follow-up: 3-4 months**
	Stop sulfonylurea if present; if TBR is >10% also decrease basal insulin dose by 10% If not on sulfonylurea, decrease basal insulin by 10% if TBR ≤10% and by 20% if TBR>10% **Follow-up: 2-4 weeks**
	Start or increase dose of GLP-1 RA or GIP/GLP-1 RA **AND** if TIR is 50-70% either stop sulfonylurea (if present), or decrease basal insulin dose by 20% If GLP-1 RA or GIP/GLP-1RA not started, or on max tolerated dose: increase basal insulin by 20% if TIR <30%, otherwise increase basal insulin by 10% • If glucose is low overnight* after looking at AGP curve, maintain current basal insulin dose and refer to diabetes education or endocrinology for regimen assessment and adjustment **Follow-up: 2-4 weeks**
n	To minimize hypoglycemia today: • Stop sulfonylurea if present AND if TBR is >10% also decrease basal insulin dose by 10% • If not on sulfonylurea, decrease basal insulin by 10% if TBR is ≤10% and by 20% if TBR >10% Work in conjunction with diabetes education or endocrinology based on local resources to improve hyperglycemia Options to treat hyperglycemia include: • Start or increase GLP-1 RA or GIP/GLP-1 RA (**preferred**) • Or add mealtime bolus insulin at 1, 2, or all meals (*see Table A*) **Follow-up: 2-4 weeks**

*Low glucose defined as 5% line dropping below 70 mg/dL on AGP curve AND not due to a single day after review of daily profiles

Clinician CGM Guided Management:
For Patients on Basal and Bolus Insulin

	TIR/TBR Category	Action
1	**Time in range >70%** and **Time below range <3%**	Continue regimen
2	**Time in range >70%** and **Time below range ≥3%**	Address hypoglycemia
3	**Time in range ≤70%** and **Time below range <3%**	Address hyperglycemia
4	**Time in range ≤70%** and **Time below range ≥3%**	Address hypoglycemia today; also refer to diabetes education or endocrinology

* Low glucose defined as 5% line dropping below 70 mg/dL on AGP curve AND not due to just a single day after review of daily profiles **

* Low glucose defined as 5% line dropping below 7
of daily profiles

	Medication Adjustment Considerations
	Continue to optimize current therapy and reinforce lifestyle changes and taking medications as prescribed. CONSIDER further intensification of insulin if appropriate: • **Step 1:** Address postmeal hyperglycemia: If there is a postmeal rise of >50 mg/dL in the median line after any meal, increase the mealtime bolus insulin dose before that meal by 5% • **Step 2:** Address basal insulin: If there is a drop of >50 mg/dL in the median line between bedtime and morning meal, decrease basal insulin dose by 5% • **Step 3:** If no change based on steps 1 or 2: Increase basal insulin dose by 5% **Follow-up: 3-4 months**
	If low* overnight decrease basal insulin** If low* at one specific time during the day decrease mealtime bolus dose** prior to the low If low* glucose occurs throughout the day and night decrease total daily insulin dose (TDD)** **Follow-up: 2-4 weeks**
	Start or increase dose of GLP-1 RA or GIP/GLP-1 RA **AND** if TIR is 50-70% decrease total daily insulin dose (TDD) by 20% If GLP-1 RA or GIP/GLP-1 RA not started or increased, then adjust insulin doses according to current TIR: • If TIR <50%: —If **not** on all-meal coverage, move to all-meal coverage by increasing TDD by 10% and using Table B to calculate new regimen. —If **on** all meal coverage, increase TDD by 10% and redistribute insulin 50:50 between basal and bolus insulin • If TIR 50-70%: review AGP curve and adjust insulin based on **median line** as follows: —**Step 1:** Address postmeal hyperglycemia: If there is a postmeal rise of >50 mg/dL in the median line after any meal, either increase the mealtime bolus insulin dose before that meal by 10% or start mealtime bolus insulin at that meal (see stepwise approach, Table A) —**Step 2:** Address basal insulin: If there is a drop of >50 mg/dL in the median line between bedtime and morning meal, decrease basal insulin dose by 10%, unless basal insulin dose was reduced in Step 1 based on stepwise approach shown in Table A —**Step 3:** If no change based on steps 1 or 2: Increase basal insulin dose by 10% **Follow-up: 2-4 weeks**
n	If low* overnight decrease basal insulin** If low* at one specific time during the day decrease mealtime bolus dose** prior to the low If low* glucose occurs throughout the day and night decrease total daily insulin dose (TDD)** **Refer to diabetes education or endocrinology** to treat hyperglycemia while avoiding hypoglycemia; they may recommend adding or adjusting GLP-1 RA or GIP/GLP-1 RA. If one of these is not started or increased, then insulin may be redistributed 50:50 between basal and bolus insulin and/or individual insulin doses titrated **Follow-up: 2-4 weeks**

** Insulin dose reduction guidance: If TBR <10% reduce insulin dose(s) by 10%; if TBR ≥10% reduce insulin dose(s) by 20%

he dropping below 70 mg/dL on AGP curve AND not due to just a single day after review

Clinician CGM Guided Management:
For Patients on **Premixed Insulin**

	TIR/TBR Category	Action
1	**Time in range >70%** and **Time below range <3%**	Continue regimen
2	**Time in range >70%** and **Time below range ≥3%**	Address hypoglycemia
3	**Time in range ≤70%** and **Time below range <3%**	Address hyperglycemia
4	**Time in range ≤70%** and **Time below range ≥3%**	Address hypoglycemia today; increase insulin at dose NOT causing hypoglycemia if feasible; also refer to diabetes education or endocrinologist

*

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Tips when using premixed insulin

A. Administer premixed insulin 15-20 minutes prior to breakfast and evening meal

B. Confirm relatively consistent mealtimes and carbohydrate quantity at meals

C. If irregular mealtimes or carbohydrate quantities at meals, consider transition to basal-bolus insulin regimen

	Medication Adjustment Considerations
	Continue to optimize current therapy; reinforce lifestyle changes and taking medications as prescribed; consider increasing premixed insulin dose prior to largest rise in the median line by 5% if no hypoglycemia* Follow-up: 3-4 months
	Confirm premixed insulin is being administered 15-20 minutes prior to breakfast and evening meal Decrease premixed insulin dose(s) administered prior to hypoglycemia* by 10% if TBR ≤10%, or by 20% if TBR >10% or "very low" is ≥2% Follow-up: 2-4 weeks
	Start or increase dose of GLP-1 RA or GIP/GLP-1 RA **AND** if TIR is 50-70% decrease total daily dose (TDD) of insulin by 20% If GLP-1 RA, GIP/GLP-1RA not started, or on max tolerated dose, adjust insulin doses according to current TIR: • **If TIR <30%** and 5% line consistently >120 mg/dL increase each insulin dose by 20%; otherwise increase each insulin dose by 10% • **If TIR 30-<50%** increase each insulin dose by 10% • **If TIR 50-70%** review AGP curve and increase premixed insulin dose by 10% prior to largest rise in the median line Follow-up: 2-4 weeks
	Confirm premixed insulin is being administered 15-20 minutes prior to breakfast and evening meal If hypoglycemia* is present after both AM and PM doses, consider transition to basal-bolus insulin Otherwise, decrease premixed insulin dose(s) prior to hypoglycemia* by 10% if TBR is ≤10%, or by 20% if TBR >10% or "very low" is ≥2% to eliminate hypoglycemia, AND consider increasing the other insulin dose by 5-10% Options to treat hyperglycemia include: • Start or increase GLP-1 RA or GIP/GLP-1 RA (**preferred**) • Start basal and bolus insulin (see Table A). Move to CCGM Basal and Bolus table. • Consider referral to diabetes education or endocrinology Follow-up: 2-4 weeks

*Hypoglycemia defined as 5% line dropping below 70 mg/dL on AGP curve AND not due to a single day after review of daily profiles

*Hypoglycemia defined as 5% line dropping below 70 mg/dL on AGP curve AND not due to a single day after review of daily profiles

Table A. Therapy Options That May Be Added to Basal Insulin

Medication Option	Action
GLP-1 RA or GIP/GLP-1 RA	Consider adding GLP-1 RA or GIP/GLP-1 RA instead of starting mealtime bolus insulin. When adding GLP-1 RA or GIP/GLP-1 RA, if: • A1C or GMI ≤8% or TIR >50%, reduce basal insulin dose by 20% • A1C or GMI >8% or TIR ≤50%, maintain current basal insulin dose
Stepwise approach to adding 1-2 mealtime bolus insulin doses	Give mealtime bolus insulin dose equivalent to 10% of basal insulin dose (basal multiplied by 0.1): • Before 1 or 2 meals **AND** • Subtract this number of units from basal insulin dose *Example:* *60 units basal insulin x 0.1 = 6 units added before 1 meal and subtracted from basal insulin dose (new basal insulin dose of 54 units) or 6 units added before* *2 meals and 12 units subtracted from basal insulin dose (new basal insulin dose of 48 units).*
Adding mealtime bolus insulin doses to all meals	Determine: • Total daily dose (TDD) of current regimen **AND** • Redistribute TDD 50% as basal insulin and 50% mealtime bolus insulin equally (as possible) before 3 meals *Example:* ***Current regimen*** • *TDD 60 units basal insulin* • *60 units x 0.5 = 30 units basal insulin* • *Then, distribute remaining 30 units equally as mealtime bolus insulin before 3 meals* ***New regimen*** *30 units basal insulin and 10 units mealtime bolus insulin before each of the 3 meals (TDD = 60 units)*

Table B. Moving from Basal Insulin Plus 1 or 2 Mealtime Bolus Insulin Doses to All Meal Coverage

Action
Determine: • Total daily dose (TDD) of current regimen • Add 10% to TDD • Redistribute TDD 50% as basal insulin and 50% as mealtime bolus insulin equally (as possible) before 3 meals *Example:* ***Current regimen*** • *60 units basal insulin + 20 units mealtime bolus insulin at dinner = 80 units TDD* • *80 units x 0.1 (10%) = 8 units insulin to be added* • *New TDD = 88 units* • *Distribute 50% as basal insulin and 50% as mealtime bolus insulin equally (as possible) before 3 meals* ***New regimen*** *44 units basal insulin and 44 units mealtime bolus insulin divided before each of the 3 meals (such as 14 units/15 units/15 units)*

Tips for Effective CGM-Based Insulin Titration

1. **Change therapy based on patterns of hypoglycemia or hyperglycemia,** rather than isolated outlying values caused by more-than-usual physical activity, eating out/special occasions, possible sensor issues, etc.

2. **If consistent rise in post-meal glucose,** explore if this is due to consumption of sugar-sweetened beverages, fruit juice or other high carbohydrate containing foods

3. **Consider potential issues with insulin regimen:**
   - Missed or rationed insulin or noninsulin therapies
   - Timing of insulin dosing:
     - — Not taking mealtime or premixed insulin before eating (15 min for rapid-acting and 30 min for regular)
     - — Timing of basal insulin (e.g. consider moving from evening to morning for better daytime glucose management and reduced nocturnal hypoglycemia)
     - — Skipping meals when using premixed insulin may lead to hypoglycemia
   - "Insulin stacking" causing low glucose: Taking extra insulin for ↑BG within 3 hrs of prior mealtime bolus insulin dose
     - — Be wary of insulin stacking when covering snacks
   - Consider possible need for mealtime bolus insulin or GLP-1 RA if excessive post-meal hyperglycemia
   - Lipohypertrophy (caused by repeated insulin injections in the same location) can cause erratic insulin absorption
   - Injecting incorrect insulin type (e.g. taking 50 units of rapid acting insulin instead of 50 units basal insulin)

4. **If sudden increase in time above range, consider acute reasons** including expired/degraded insulin, improperly stored insulin (high or low temp), acute infection/illness, initiation of steroid therapy, rationed insulin, vacation

5. **Ask if excessive alcohol intake** could be the cause of hypoglycemia

6. **Consider undiagnosed T1D** if dramatic post-meal hyperglycemia on basal insulin only (assess for lower BMI, family history of type 1 diabetes, history of other autoimmune diseases, poor response to non-insulin therapies, autoantibodies)

Basics of Hypoglycemia Management

Hypoglycemia is defined as glucose <70 mg/dL.
Symptoms may include feeling shaky, sweaty, hungry or irritable.
Ask patients to always carry a carbohydrate containing food or beverage.

Follow the "Rule of 15 to Treat Lows":

1. Treat with 15 grams of carbohydrate (Example: 4 glucose tablets, 5–6 crackers or a half cup fruit juice).
2. If glucose is < 54 mg/dL, treat with 30 grams of carbohydrate
3. Recheck glucose 15 min after treatment to ensure glucose > 70 mg/dL.
4. If glucose < 70 mg/dL after 3 treatments, call primary care clinician or 911.

Avoid overtreating lows, since that can result in rebound hyperglycemia.

Teach glucagon administration. Nasal glucagon (preferred), prefilled glucagon pen and glucagon injection kit are available.

Symptoms of Low Glucose

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