Methods of Monitoring for Diabetes

Author: Drew Klinkebiel, PharmD, BCACP, BC-ADM, CDCES; Reviewed by Mikayla DeNoon, PharmD

Executive Summary

There are currently two approaches to monitoring blood sugar levels in those living with diabetes: use of a glucometer and test strips or a CGM system. CGM has proven clinical benefit with increased time in range and decreased hypoglycemia; however, the decision of which method of monitoring is best will vary based upon the patient, medications being used and cost.

Acronyms	
A1C	Hemoglobin A1C test
CGM	Continuous glucose monitor
CSII	Continuous subcutaneous insulin infusion
DME	Durable medical equipment
FDA	Food and Drug Administration
MDI	Multiple daily insulin injections
T1DM	Type 1 diabetes mellitus
T2DM	Type 2 diabetes mellitus

Key Takeaways

- CGM has demonstrated benefit in patients treated with insulin and is recommended in this population.
- A glucometer may be preferred in patients on oral and non-insulin medications, or in patients who are more prone to anxiety with extensive information on glycemic results and trends.
- CGM has become more broadly covered over the last few years. If CGM is desired, recommend sending a prescription to the patient's pharmacy first. If not covered or the patient's preferred pharmacy cannot fill, utilize Avera Specialty Pharmacy to fill the prescription or identify where a prescription needs to be sent.

Continuous Glucose Monitoring

CGM have demonstrated improved clinical outcomes when compared to finger-stick glucose readings. A recent study demonstrated that at the end of an 8-month timeframe, 63% of patients using CGM to guide basal insulin adjustments had an A1C <8.0% compared to only 39% of patients using a glucometer, a relative increase of 62%. Patients using CGM spent an average of 3.8 hours more each day within goal range and 3.6 hours less each day in the very high glucose range, while also having a reduction in hypoglycemia.

Another study showed in adults ≥60 years of age with T1DM or T2DM using MDI, CGM use was associated with a reduction in A1c (-0.4 +/- 0.1%), decreased glycemic variability and less time spent >250 mg/dL with a high degree of patient satisfaction.

The American Diabetes Association says CGM should be offered for diabetes management in adults with diabetes on basal insulin, MDI or CSI) who are capable of using the devices safely. With improved clinical outcomes and ease of use for the patient, more patients are likely to inquire about and/or benefit from CGM.

CGM constantly monitors the blood sugar level with a sensor placed just under the skin into the interstitial fluid. Both CGM and glucometer use result in knowing a glycemic level, so which is better or when is each recommended can vary depending on the patient, their diabetes medication regimen and cost.

Table 1 gives some suggestions of when each method may be preferred.

Table 1: Continuous Glucose Monitoring Method Preferences

Glucometer	CGM
Patient preference toward a simple plan yielding a few data points per week	Patient desire to see more complex glycemic trends throughout the day and night
Prone to increased anxiety by having knowledge of glycemic level and trends	Motivated by data to improve self-care and overall health
Limited interest or difficulty with technology	Technologically savvy and/or interested by newer technologies
Use of oral and non-insulin diabetes medications	Use of insulin administered via injections or an insulin pump
More stable glycemic trends with minimal concern for significant hypoglycemia	Higher glycemic variability with a greater risk of hypoglycemia
Patients in earlier stages of type 2 diabetes	Patients with type 1 or later stages of type 2 diabetes
Patients living with others in a supportive environment	Patients living alone or with limited social support
Cash price $25-75 per month without insurance	Cash price $150-500 per month without insurance

Additional Considerations for Use of CGM

- Many patients struggle with adhesion issues with their sensors. Patients may require use of a liquid adhesive agent (e.g., Skin Tac or Skin Prep) and/or adhesive patches or tape.
    - Those who exercise may struggle more with adhesion, especially swimmers or runners.
- Patients may experience some inaccuracies in their CGM data.
    - The first day of a new sensor may result in glucose readings that are less consistent with readings from a glucometer. Readings should become more aligned over the first 24 hours of use.
    - Pressure on the sensor can affect readings, and most patients notice this when they sleep on the sensor. This can result in errors, loss of readings and aberrant readings (usually a drop in glucose reading although some patients may see large spikes).
    - Medication interactions
        - Libre 2 and 3
            - Ascorbic acid doses >500 mg can falsely elevate glucose readings.
        - Dexcom G6 and G7
            - Hydroxyurea can falsely elevate glucose readings.
            - Acetaminophen doses greater than the maximum of 4000 mg/day can falsely elevate glucose readings.
- Patient perceptions of inaccuracies of data
    - Sensor glucose measures glucose in the interstitial fluid, while a glucometer measures glucose in the blood. Because of this, CGM results will rarely match a glucometer result.
        - When glucose levels are rising, a glucometer result is expected to be greater than the CGM result.
        - When glucose levels are falling, a glucometer result is expected to be lower than the CGM result.
        - When rising or falling quickly, the difference between glucometer and CGM is expected to be larger.
            - This may occur after meals, after rapid-acting insulin doses or during exercise.
    - All glucose testing devices carry different margins of error.
        - FDA guidance specifies accuracy standards for glucometers:
            - 95% of all measured glucometer values must be within 15% of the true value

(lab measurement); and
    - 99% of values must be within 20% of the true value.
- The FDA also provides detailed standards for CGM accuracy.
- There can be great variability between individual glucometers as well as between glucometer and CGM.

CGMs Insurance Coverage - General

Insurance coverage for CGMs is typically more restrictive than for glucometers, with many plan requiring treatment with insulin and/or severe hypoglycemia. To clarify coverage, the insurance company can be contacted to explain their terms of coverage or prescriptions can be sent to the patient's pharmacy to check coverage. If not covered, pharmacies will generally receive a message back from the insurance company providing their coverage criteria or indicating a need for prescriptions to be sent to a DME supplier to be processed as a medical benefit.

Medicare Coverage

Medicare currently covers CGMs for those meeting the following criteria:

1) Have a diagnosis of diabetes mellitus
2) CGM is being prescribed to improve glycemia control for a patient who is insulin treated or has a history of problematic hypoglycemia
3) The treating practitioner has an in-person or Medicare-approved telehealth visit with the patient to evaluate their diabetes control; and
4) Patient uses a stand-alone receiver or insulin infusion pump classified as DME to display glucose data. If patient does not use a stand-alone CGM receiver, they will not receive coverage. Patient is allowed to use a non-DME device (e.g., smart phone) in conjunction with the stand-alone receiver.
5) The treating practitioner must have in-person or Medicare-approved telehealth visits as part of ongoing provision of the CGM.

Traditional Medicare covers CGMs under Part B as medical equipment so prescriptions should be sent to the pharmacy electronically and include an ICD-10 code. Most chain community pharmacies can process Part B claims; however, some may not process CGMs.

> If a patient is unable to get a CGM system from their preferred pharmacy, send the prescription to the Avera Specialty Pharmacy in Sioux Falls, SD as they are an approved DME supplier of CGM supplies. Avera Specialty Pharmacy may be able to fill and ship the supplies to the patient or identify where the prescription needs to be sent for the patient.

Medicaid Coverage

State Medicaid coverage for CGMs will vary, but typically require patient to be on insulin therapy and/or history of severe hypoglycemia. Prior authorization is required to determine coverage.

Avera Health Plans Coverage

Avera Health Plans offer coverage for CGMs as a pharmacy benefit with no preauthorization required. Freestyle Libre and Dexcom are covered on the preferred brand tier on the Avera formularies.

Other Commercial Coverage

Most commercial payers will offer coverage for CGMs to patients with type 1 diabetes and many will cover for those with type 2 diabetes. Most commercial plans will offer coverage under the pharmacy benefit; however, some

may only cover under the medical benefit. Recommend sending a prescription to the patient's preferred pharmacy, and if not covered or issues arise, send the prescription to the Avera Specialty Pharmacy.

Glucometer Insurance Coverage - General

Glucometers and related supplies are generally covered for all patients who need them with the challenge being to choose the formulary or preferred system for each insurance. The challenge of choosing the correct system can be minimized by sending prescriptions for general/universal items such as:

- Glucometer
- Test Strips
- Lancets

By entering general terms rather than selecting specific, branded products, this will allow the pharmacist to work with the patient and insurance company to find the right products without seeking clarification and approval from the prescribing clinician.

References

Martens T, Beck RW, and Bailey R. Effect of Continuous Glucose Monitoring on Glycemic Control in Patients with Type 2 Diabetes Treated with Basal Insulin. *JAMA*. 2021;325(22):2262-72.

Centers for Medicare & Medicaid Services. Glucose Monitor – Policy Article (A52464). Available from: https://www.cms.gov/medicare-coverage-database/view/article.aspx?articleId=52464. Accessed March 22, 2024.

South Dakota Department of Social Services. Continuous Glucose Monitor Coverage and Billing Changes. Available from: https://dss.sd.gov/docs/medicaid/providers/ProviderBulletins/2023/12.01.23_Continuous_Glucose_Monitor_Coverage_and_Billing_Changes.pdf. Accessed March 22, 2024.

MN Department Of Human Services. Diabetic Equipment and Supplies. Available from: https://www.dhs.state.mn.us/main/idcplg?IdcService=GET_DYNAMIC_CONVERSION&RevisionSelectionMethod=LatestReleased&dDocName=DHS16_144501#cs. Accessed March 22, 2024.

State of Iowa Department of Health and Human Services. Continuous Glucose Monitoring DME-006. Available from: https://hhs.iowa.gov/media/311/download?inline=. Accessed March 22, 2024.

Nebraska Department of Health and Human Services. Nebraska Department of Health and Human Services Health Plan Advisory No. 20-22. Available from: https://dhhs.ne.gov/Medicaid%20Health%20Plan%20Advisories/Health%20Plan%20Advisory%2022-02.pdf. Accessed March 22, 2024.

Guideline Owner: Pharmacy Pearls Committee
Date(s) of Guideline Approved/Reviewed: 3/2022, 8/2024
Original Guideline Review Committee: Becky Vande Kop, MD, Chad Thury, MD

Clinical Utilization of Continuous Glucose Monitoring

Author: Drew Klinkebiel, PharmD, BCACP, BC-ADM, CDCES

Executive Summary

An A1c level has been an important measure of diabetes management, however when used alone, it may not be sufficient to optimally guide an individualized approach to diabetes management. CGM is a powerful tool that can provide more insight into hypo- and hyperglycemic trends, glucose variability and the time spent in goal range. When available, CGM should be used as an additional tool to optimize medication therapy and behavioral changes. To fully leverage this technology, it is important to understand the CGM report and the different metrics available in the report. The AGP report is a standardized, one-page summary with four main elements: Glucose Statistics or Metrics, Time in Ranges, the AGP and Daily Glucose Profiles.

Acronyms	
A1c	Hemoglobin A1c
AGP	Ambulatory Glucose Profile
CGM	Continuous Glucose Monitor
eA1c	Estimated hemoglobin A1c

Key Takeaways

When reviewing CGM reports, it is important to understand the meaning of each component and the goals associated with the metrics provided.

- Ensure enough data is available to interpret (at least 70% of time that CGM is active).
- Assess the differences between the GMI and the laboratory A1c value and use the GMI to better individualize goal A1c.
- The goal for time in range is >70% while keeping time above range <25% and time below range <4%.
- A glucose variability (or coefficient of variation) ≤36% indicates relatively stable glucose levels.
- Use the AGP to quickly identify patterns of low or high glucose.

Glucose Statistics or Metrics

Date Range and Data Sufficiency: 14 days of CGM data correlates well with three months of CGM data regarding mean glucose, time in range and hyperglycemic measures. A percentage of time CGM is active of at least 70% or ~10 days adds confidence that the data is a reliable indicator of usual patterns.

Average Glucose: highly correlates with hemoglobin A1c and measures of hyperglycemia, however if used in isolation, it provides no insight into glucose patterns, glycemic variability or hypoglycemia.

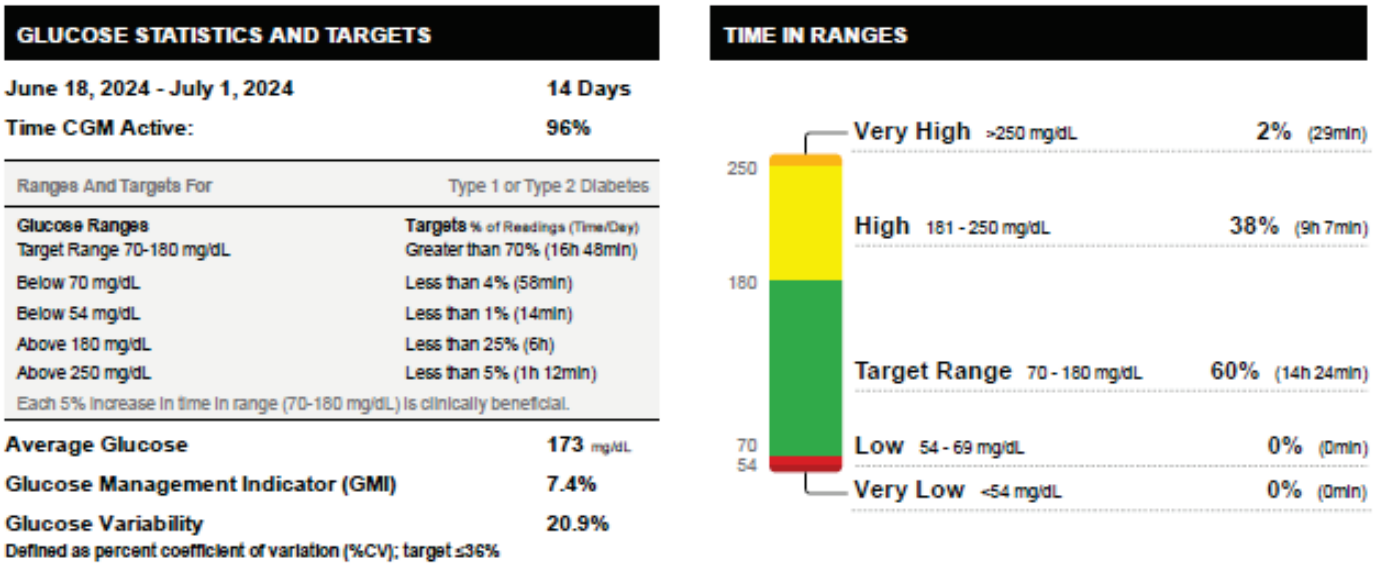
Glucose Variability (Coefficient of Variation): Refers to how much individual glucose readings vary from the average glucose. Defined as the standard deviation divided by the average glucose. A value of less than or equal to 36% indicates low glycemic variability and relatively stable glucose levels.

Glucose Management Indicator: The CGM version of eA1c for the timeframe of glucose data being reviewed. Discrepancies between the GMI and laboratory A1c may exist for various reasons such as:

- The measurement of glucose attached to hemoglobin in red blood cells versus the measurement of glucose in the interstitial fluid
- Differences in how glucose attaches to red blood cells
- Medical conditions that may affect the life span of red blood cells

The GMI may also be higher or lower than the laboratory A1c during periods of acute glycemic change such as:

- With illness or steroid use
- When starting a lower carbohydrate diet
- With intensive exercise regimens
- Right after starting a new glucose lowering medication



GLUCOSE STATISTICS AND TARGETS

June 18, 2024 - July 1, 2024	**14 Days**
Time CGM Active:	**96%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 70-180 mg/dL	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose	**173** mg/dL
Glucose Management Indicator (GMI)	**7.4%**
Glucose Variability	**20.9%**

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

Very High >250 mg/dL	**2%**	(29min)
High 181 - 250 mg/dL	**38%**	(9h 7min)
Target Range 70 - 180 mg/dL	**60%**	(14h 24min)
Low 54 - 69 mg/dL	**0%**	(0min)
Very Low <54 mg/dL	**0%**	(0min)

250
180
70
54

Figure 1. Example of Glucose Statistics and Metrics and Time in Ranges from an AGP report

Time in Ranges

This includes the percentage of time that the patient's glucose level is within the target range (70-180 mg/dL), in addition to the amount of time that the patient's glucose levels are above and below this target range. See **Figure 1** for the definition of glucose ranges and goals for time in ranges.

Ambulatory Glucose Profile

The AGP represents 14 daily glucose profiles combined into a single visual display. The solid line represents the median glycemic level with the darker shaded area including the 25th to 75th percentiles (50% of all values) and the lighter shading the 5th to 95th percentiles (90% of all values). The AGP gives insight into when a patient may be prone to high or low glycemic levels and require more attention. The goal is to keep the curve as narrow and flat as possible within the target range.

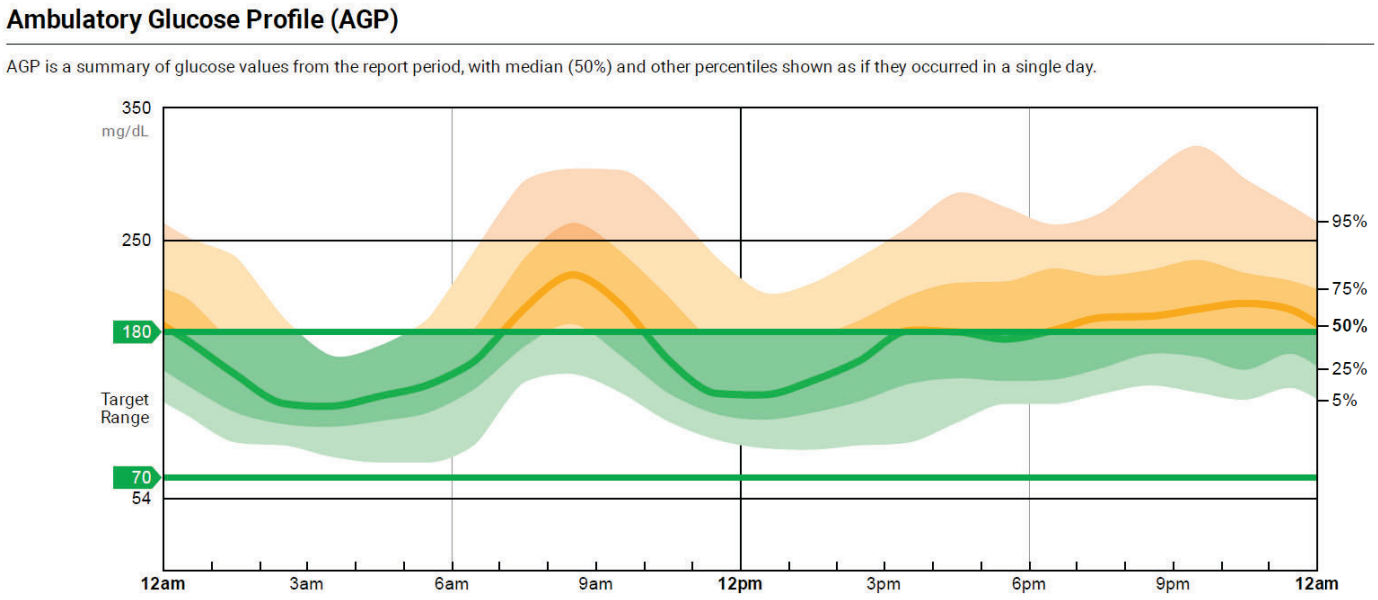


Figure 2. Example AGP graph from AGP report

Daily Glucose Profile

Shows the last 14 daily profiles which can be used to assess the cause of glycemic patterns and the need to look at other reports to pinpoint opportunities for improvement.

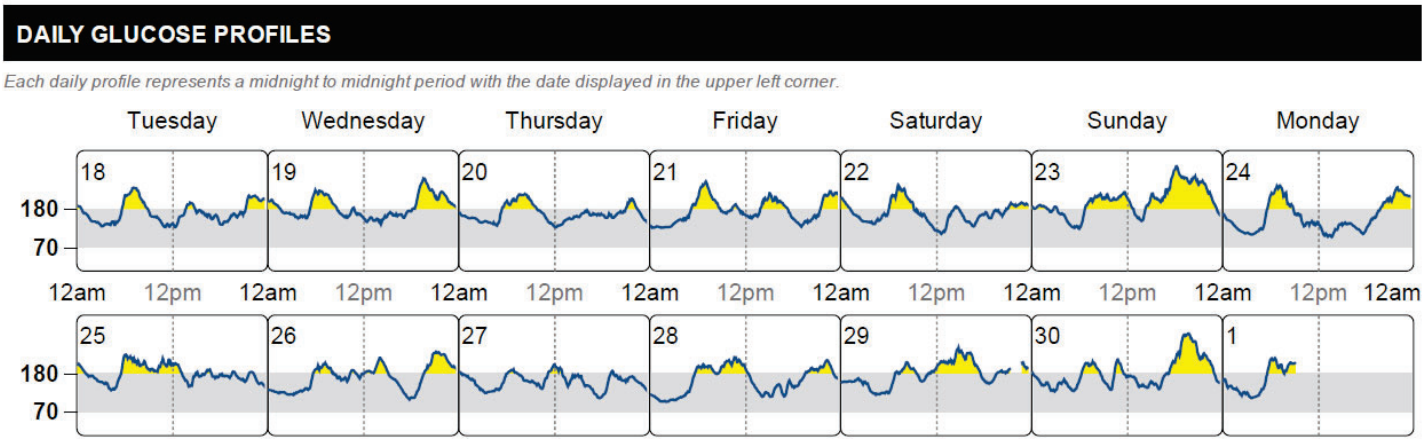


Figure 3. Example of Daily Glucose Profile from AGP report

Tips for Effective Review of the AGP to Guide Clinical Decision Making

1. Ensure there is adequate data to make a clinical decision (data sufficiency).
2. Ask your patient to describe/explain what he/she sees on the report and why.
3. Look for patterns of low glucose.
    a. From the example above, >5% of readings from 10 a.m. to 12 p.m. are below 70 mg/dL and immediate action should be taken.
    b. Use the daily glucose profiles to identify patterns of low glucose (e.g., weekends vs. weekdays).
4. Look for patterns of high glucose.
    a. Assess for adherence to medications.
    b. Discuss with the patient whether high values are before or after typical mealtimes.
    c. Assess for differences between weekdays and weekends.
5. Assess glucose variability and discuss lifestyle modifications that could be implemented to try and reduce the variability (e.g., adjust time/amount of food intake, carbohydrate counting, timing of medications, exercise or stress).
6. Compare the current AGP report to the report from the last visit to assess progress; what worked and what could be improved?
7. Formulate new care plan – always treat hypoglycemia first!

Billing for CGM Interpretation

Review of CGM Interpretation is a billable service, typically allowable once a month. See the Expanse tipsheet for more information on billing CGM interpretation.

References

Bergenstal RM. Understanding Continuous Glucose Monitoring Data. 2018 Aug. In: Role of Continuous Glucose Monitoring in Diabetes Treatment. Arlington (VA): American Diabetes Association; 2018 Aug. Available from: https://www.ncbi.nlm.nih.gov/books/NBK538967/ doi: 10.2337/db20181-20.

American Diabetes Association Professional Practice Committee. 6. Glycemic goals and hypoglycemia: Standards of Care in Diabetes— 2024. Diabetes Care 2024;47(Suppl. 1):S111–S125.

Schumacher CA, Isaacs D, Collier I, Klinkebiel D. Use of continuous glucose monitoring to improve glycemic management: A clinician's guide. J Am Coll Clin Pharm. 2020;3:1333–1343.

Guideline Owner: Pharmacy Pearls Committee
Date(s) of Guideline Approved/Reviewed: 3/2022, 7/2024
Original Guideline Review Committee: Becky Vande Kop, MD, Chad Thury, MD

Content Author: Klinkebiel, PharmD

GLP-1 Receptor Agonists – Not All Are Created Equal

Authors: April Krull, PharmD, and Samantha Scheich, PharmD

Executive Summary

Although GLP-1 agents are all contained within the same class, differences in duration of action (e.g., short-acting vs. long-acting), effects on glycemic control and weight loss, tolerability profiles and administration routes offer providers several options to choose from. Added to this overview is the dual acting GLP-1/GIP agonist tirzepatide.

Acronyms	
ADA	American Diabetes Association
ASCVD	Atherosclerotic cardiovascular disease
CKD	Chronic kidney disease
CVD	Cardiovascular disease
ER	Extended release
GLP-1 RA	Glucagon-like peptide-1 receptor agonists
GI	Gastrointestinal
GIP	Glucose-dependent insulinotropic polypeptide
IR	Immediate release
Subcut	Subcutaneous

Key Takeaways

- Long-acting GLP-1 RAs tend to have greater A1C lowering and greater weight loss associated.
- For patients struggling with GI adverse effects, exenatide ER is typically associated with lower risk of adverse effects, while exenatide IR and semaglutide subcut may be associated with the highest risk for adverse effects.
- Tirzepatide may have the biggest impact on A1C lowering and weight loss across all GLP-1 agonists, however, data on cardiovascular outcomes is not expected until 2025.

Drug Shortages and Compounded Products

High demand for GLP-1 agents, especially for their weight loss effects, have resulted in significant drug shortages. This has caused some compounding pharmacies to begin making GLP-1 products. Patients and providers should be aware that this practice is not currently authorized by the FDA. Additionally, these products have not been studied for safety and efficacy outcomes as the compounded products contain a different salt form/base than commercially available products.

The FDA has received adverse event reports after patients used compounded semaglutide. Patients should not use a compounded drug if an approved drug is available to treat a patient. Patients and health care professionals should understand that the agency does not review compounded versions of these drugs for safety, effectiveness, or quality. See the FDA website for more information on compounded semaglutide.

Table 1: Recommendation for Prescribing Information on GLP-1 RAs

Generic Name	Short/Long Acting*	Initial Dose	Frequency	Route
Dulaglutide**	Long	0.75mg weekly x 4-8 weeks; may increase dose every 4-8 weeks to 1.5mg, then 3mg, then to max of 4.5mg	Once weekly	Subcut
Exenatide	Short	5mcg twice daily x 1 month; then 10mcg twice daily	Twice daily	Subcut
Exenatide ER	Long	2mg weekly	Once weekly	Subcut
Liraglutide**	Long	0.6mg daily x 1 week then 1.2mg; may increase to 1.8mg	Once daily	Subcut
Lixisenatide***	Short	10mcg daily x 14 days; then 20mcg daily	Once daily	Subcut

Semaglutide**	Long	0.25mg weekly x 4 weeks, then 0.5mg weekly; may increase to 1mg weekly	Once weekly	Subcut
Semaglutide	Long	3mg daily x 30 days, then 7mg; may increase to 14mg	Once daily	Oral
Tirzepatide	Long	2.5mg weekly x 4 weeks, then 5mg weekly; may increase dose every 4 weeks in 2.5mg increments to max of 15mg	Once weekly	Subcut

* Short-acting GLP-1 RAs provide short lived and intermittent receptor activation, while long-acting GLP-1 RAs have a steadier, consistent exposure, with small fluctuations in drug concentrations over a 24-hour period. Short-acting GLP-1 RAs have a more pronounced effect on postprandial hyperglycemia and gastric emptying, while long-acting GLP-1 RAs have a greater effect on fasting glucose.

** These GLP-1 RAs are preferred due to their demonstrated cardiovascular benefit.

** Lixisenatide is not available as a stand-alone agent. Currently only available in combination with insulin glargine.

Table 2: Recommendation for Prescribing Information for GLP-1 RA Pharmacokinetics

	Short-Acting	Long-Acting
Time duration	2-to-3-hour half-life	Half-life • Liraglutide: 13 hours • All others: 5 to 14 days
Fluctuations in plasma drug concentration	Large	Smaller
Peak effect on plasma glucose	Exenatide: 12 weeks	Dulaglutide and Liraglutide: 2 to 4 weeks
	Lixisenatide: 2 to 4 weeks	Exenatide: 6 to 14 weeks
		Semaglutide: 12 to 16 weeks

Table 3: Efficacy Comparison*

	Low	Intermediate	High	Highest
A1C Lowering	Exenatide Lixisenatide	Exenatide XR Dulaglutide Liraglutide	Semaglutide	Tirzepatide
Weight Loss	Exenatide Exenatide XR Lixisenatide	Dulaglutide Liraglutide	Semaglutide	Tirzepatide

* Average effects on A1C and weight tend to be highly dose-dependent

Adverse Events

The most common adverse events associated with GLP-1 agonists are nausea, vomiting and diarrhea. These adverse events are typically mild to moderate in severity and diminish over time with use of all GLP-1 RAs. Injection site reactions are also common, however greatest risk is seen with exenatide ER.

Table 4: GI Adverse Effects by Risk Level

Low Risk	Moderate Risk	High Risk
• Exenatide ER	• Liraglutide • Lixisenatide • Dulaglutide • Semaglutide (Oral)	• Exenatide • Semaglutide • Tirzepatide

Table 5: Equivalent and Comparative Doses

Anticipate greater efficacy with each increased dose of tirzepatide.

Agent	Equivalent Dose						
Exenatide	5 mcg	10 mcg					
Exenatide XR			2mg				
Lixisenatide	10 mcg	20 mcg					
Liraglutide	0.6mg	1.2mg	1.8mg				
Dulaglutide		0.75mg	1.5mg	3mg	4.5mg		
Semaglutide (oral)	3mg	7mg	14mg				
Semaglutide (subcut)		0.25mg	0.5mg		1mg	2mg	
Tirzepatide			2.5mg			5mg	7.5mg, 10mg, 12.5mg, 15mg

ASCVD/CKD Benefits

Studies have looked at the risk reduction in patients with CVD using GLP-1 RAs. Those studies found that while all GLP-1 RAs show non-inferiority, only three currently have shown significant reductions in composite CV outcomes:

- Liraglutide
- Semaglutide (subcut formulation only)
- Dulaglutide

Currently, these three agents all have labeled indications for risk reduction of major CV events in patients with type 2 diabetes and established CVD. Dulaglutide carries an additional indication for risk reduction of major CV events in those with multiple CV risk factors.

The ADA recommends the use of a GLP-1 RA with proven CVD benefit in patients with the following comorbidities:

- ASCVD
- High ASCVD Risk
- CKD
    - If SGLT2i is not tolerated or contraindicated

GLP-1 RAs have demonstrated a role in renal failure by preventing the onset of macroalbuminuria and slowing the decline of glomerular filtration rate. The FLOW Trial, published in May 2024, evaluated the use of semaglutide 1mg weekly versus placebo in patients with type 2 diabetes and CKD. This was the first trial published that was specifically evaluating kidney outcomes of a GLP-1 RA as a primary endpoint. Results showed a 24% lower risk of the primary outcome (onset of kidney failure, ≥50% reduction in eGFR from baseline, or death of kidney-related or cardiovascular causes). This included death from cardiovascular causes which benefit has been previously demonstrated in other trials. When adjusting for kidney specific outcomes, there was a 21% risk reduction (driven by ≥50% reduction in eGFR from baseline).

The ADA has yet to make any guideline changes since the FLOW trial was published, so it is still recommended to first utilize a SGLT-2 inhibitor in patients with CKD and type 2 diabetes. While there are no studies directly comparing kidney outcomes of SGLT-2 inhibitors and GLP-1RA, kidney benefit seems a bit more favorable in the SGLT-2 inhibitor studies.

Weight Loss Indications

Currently only three of the GLP-1 RAs are also approved for weight loss. Each is approved under a different brand name than the diabetes approved product. All agents are approved as an adjunct to a reduced-calorie diet and increased physical activity for chronic weight management in adult patients with an initial body mass index of ≥30 kg/m2 (obesity) or ≥27 kg/m2 (overweight) in the presence of at least one weight-related comorbid condition (e.g., hypertension, type 2 diabetes mellitus, dyslipidemia). Liraglutide and semaglutide are also approved for chronic weight management in pediatric patients. Semaglutide carries an additional indication for risk reduction of major adverse cardiovascular events in adults with established cardiovascular disease following results of the SELECT Trial which demonstrated a 20% reduction in the primary cardiovascular endpoint in patients with preexisting cardiovascular disease and overweight or obesity.

- Liraglutide (Saxenda)
    - Dosing: titrated by 0.6mg every week up to 3mg once daily (0.6mg, 1.2mg, 1.8mg, 2.4mg, 3mg)
- Semaglutide (Wegovy)
    - Dosing: titrated every 4 weeks up to 2.4mg once weekly (0.25mg, 0.5mg, 1mg, 1.7mg, 2.4mg)
- Tirzepatide (Zepbound)
    - Dosing: same as diabetes dosing

References

Górriz JL, Soler MJ, Navarro-González JF, et al. GLP-1 Receptor Agonists and Diabetic Kidney Disease: A Call of Attention to Nephrologists. J Clin Med. 2020;9(4):947.

Gentilella R, Pechtner V, Corcos A, Consoli A. Glucagon-like peptide-1 receptor agonists in type 2 diabetes treatment: are they all the same? Diabetes Metab Res Rev. 2019;35(1):e3070.

Dungan K, DeSantis A. Glucagon-like peptide 1 receptor agonists for the treatment of type 2 diabetes mellitus. UpToDate. Last updated Sep 1, 2021. Accessed October 12, 2021. Available at: https://www.uptodate.com/contents/glucagon-like-peptide-1-receptor-agonists-for-the-treatment-of-type-2-diabetes-mellitus?search=glp%201%20agonist&source=search_result&selectedTitle=2~98&usage_type=default&display_rank=1.

Frias JP, Wynne AG, Matyjaszek-Matuszek B, et al. Efficacy and safety of an expanded dulaglutide dose range: A phase 2, placebo-controlled trial in patients with type 2 diabetes using metformin. Diabetes Obes Metab. 2019;21(9):2048-57.

Trujillo JM, Nuffer W, Smith BA. GLP-1 receptor agonists: an updated review of head-to-head clinical studies. Ther Adv Endocrinol Metab. 2021;12:1-15.

Jain AB, Ali A, Gorgojo Martínez JJ, et al. Switching between GLP-1 receptor agonists in clinical practice: Expert consensus and practical guidance. Int J Clin Pract. 2021; 75(2):e13731.

Almandoz JP, Lingvay I, Morales J, Campos C. Switching between glucagon-like peptide-1 receptor agonists: Rationale and practical guidance. Clin Diabetes. 2020;38(4):390-402.

Pharmacologic Approaches to Glycemic Treatment: Standards of Medical Care in Diabetes – 2021

Clinical Resource, Comparison of GLP-1 Agonists. Pharmacist's Letter/Prescriber's Letter. August 2019.

Yao, H. *et al.* (2024) 'Comparative effectiveness of GLP-1 receptor agonists on glycaemic control, body weight, and lipid profile for type 2 diabetes: Systematic review and network meta-analysis', *BMJ* [Preprint]. doi:10.1136/bmj-2023-076410.

Whitley, H.P., Trujillo, J.M. and Neumiller, J.J. (2023) 'Special report: Potential strategies for addressing GLP-1 and dual GLP-1/GIP receptor agonist shortages', *Clinical Diabetes*, 41(3), pp. 467–473. doi:10.2337/cd23-0023.

Novo Nordisk A/S: Semaglutide 1.0 mg demonstrates 24% reduction in the risk of kidney disease-related events in people with type 2 diabetes and chronic kidney disease in the FLOW trial (2024) *Novo Nordisk*. Available at: https://www.novonordisk.com/news-and-media/news-and-ir-materials/news-details.html?id=167028# (Accessed: 05 April 2024).