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REVIEW PAPER

Adjunctive Treatment with GLP-1 and Dual GLP-1/GIP Receptor Agonists for People with Type 1 Diabetes: Consensus Report and Practical Guidelines for Safe Use

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Abstract

Among the most impactful therapeutic advances in the management of diabetes over the past two decades has been the development of incretin-based therapies, specifically glucagon-like peptide-1 (GLP-1) receptor agonists (RAs) and in combination with glucose-dependent insulinotropic polypeptide (GIP) RAs. Since the introduction of exenatide in 2005, a growing number of these drugs has transformed the management of type 2 diabetes (T2D). Their pleiotropic effects include weight loss, reduced insulin resistance, improved glucose regulation, and reductions in known risk markers for diabetic kidney disease and cardiovascular disease. To date, these important noninsulin glucose-lowering therapies have only received regulatory approval for use in T2D, obesity,

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sleep apnea, and metabolic dysfunction-associated steatohepatitis with moderate-advanced fibrosis, supported by randomized controlled trials (RCTs) and real-world data that demonstrate efficacy and safety. Regulatory approval for use of weekly GLP-1 and GLP-1/GIP RAs in type 1 diabetes (T1D) has not yet been achieved, in part because of the limited number of inconsistent, small-scale, RCTs and real-world studies for glycemic impacts of these agents in T1D. Larger RCTs are ongoing or planned in participants with T1D. Potential safety risks include hypoglycemia and hyperglycemia-related ketosis in T1D after initiation of GLP-1/GIP RA drugs. While RCTs are ongoing to further investigate GLP-1 and GLP-1/GIP RA agents as adjunct therapy for people with T1D, access to these drugs is already possible, based on their use to treat overweight and obesity. However, without regulatory approval for the T1D indication, access and opportunities for people with T1D to engage with important education regarding the safety of GLP-1 and GLP-1/GIP RA therapy may be limited. This precludes support from diabetes health care professionals to optimize diabetes management of these agents alongside expected insulin dose changes. The purpose of this consensus report is to review the current literature and provide guidelines for diabetes clinicians and people with T1D to facilitate the safe use of GLP-1/GIP RAs in the management of T1D. This consensus statement has been endorsed by the following professional associations: Advanced Technologies & Treatments for Diabetes (ATTD), International Diabetes Federation–Europe, American Association of Clinical Endocrinologists (AACE), Breakthrough T1D, International Society for Pediatric and Adolescent Diabetes (ISPAD), Association of Diabetes Care and Education Specialists (ADCES).

Keywords: glucose control with GLP-1 and GLP-1/GIP RA use in T1D, insulin dose changes with GLP-1 and GLP-1/GIP RA use in T1D, GI AEs in people with T1D using GLP-1 and GLP-1/GIP RAs, diabetic eye disease with GLP-1 and GLP-1/GIP RA use in T1D, glucose and ketone monitoring in people with T1D on GLP-1 and GLP-1/GIP RAs.

Introduction

Type 1 diabetes (T1D) is an autoimmune disease that targets and destroys insulin-producing β-cells in the pancreas. The discovery of insulin in 1921 was followed swiftly by its first use in people with T1D in 1922. In the intervening century, it transformed the life expectancy for people with T1D or with other insulin-requiring forms of diabetes. Insulin formulations underwent improvements over the first five decades after their discovery. However, the life expectancy of people with T1D was still reduced compared with people without diabetes. In the past 30 years, this landscape has dramatically changed. Advances in insulin formulations, insulin delivery systems using insulin pumps and pens, the introduction of continuous glucose monitoring (CGM) technology,[1] and automated insulin delivery (AID) systems[2] have been accompanied by a 2-fold increase in the proportion of people with T1D achieving glycated hemoglobin A1c (HbA1c) targets, which is well known to be associated with reductions in long-term risks for micro- and macrovascular complications of diabetes.[3] This has led to improvements in life expectancy for people with T1D in developed health care economies.[4–7] However, gaps in life expectancy between people with and without T1D persist and are largely driven by cardiovascular disease (CVD), for which people with T1D have a 2- to 4-fold increased risk,[8] and chronic kidney disease, which is 3–5 times more prevalent in people with T1D compared with those without diabetes.[9] Although glycemia is an inconsistent predictor for these long-term complications of T1D,[10] reductions in HbA1c with intensive insulin therapy are associated with significantly reduced long-term risks for these complications.[11,12] Despite this, more than 60% of children and adolescents in international diabetes registries did not achieve recommended HbA1c targets of <53 mmol/mol (<7.0%) in 2022,[13] and 85% did not achieve recommended HbA1c targets of <48 mmol/mol (<6.5%).[14] Similarly, adults with T1D recruited into clinical

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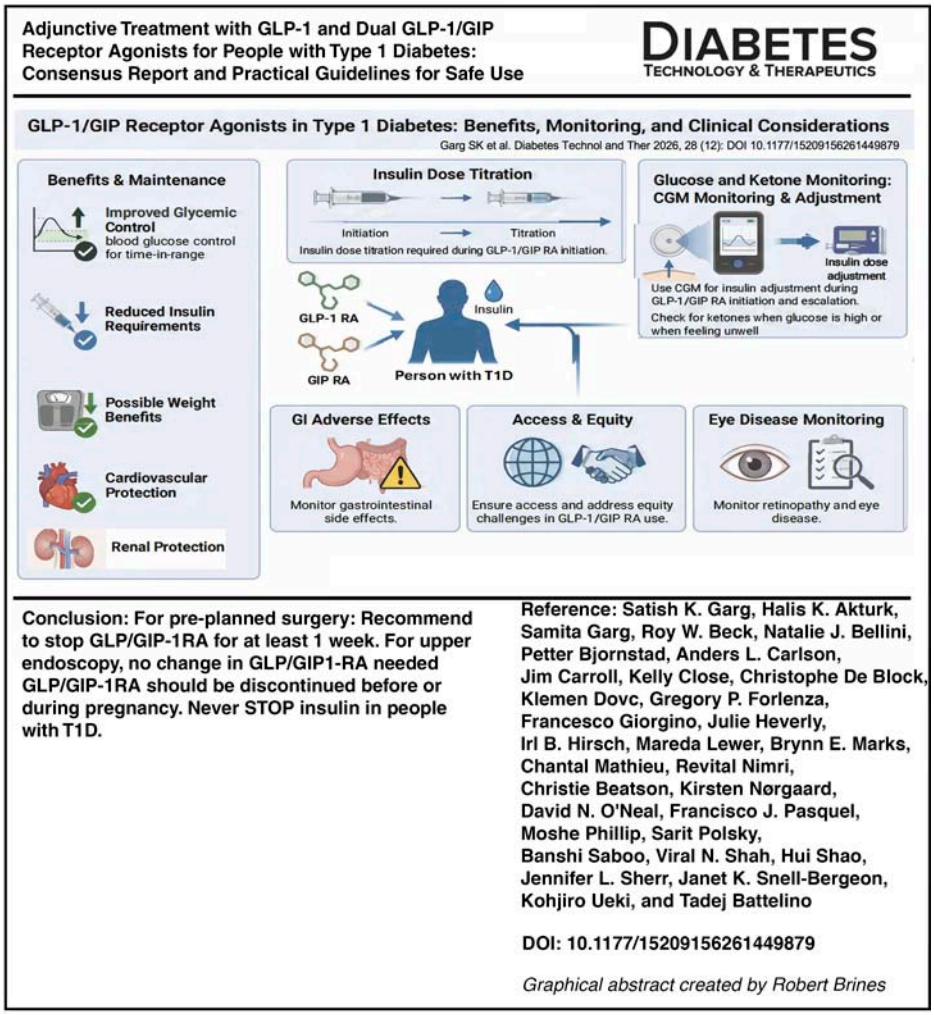

trials globally between 2016 and 2025 had a mean baseline HbA1c of 63 mmol/mol (7.9%).[15]

Incretin-based therapies, specifically glucagon-like peptide-1 (GLP-1) receptor agonists (RAs) and combinations of GLP-1 RA and glucose-dependent insulinotropic polypeptide (GIP) RAs, have transformed the management of type 2 diabetes (T2D) over the past two decades.[16,17] Both types of incretins exert pleiotropic effects on metabolism in treated individuals, as outlined in Figure 1. For the purposes of this consensus report, we refer to these agents collectively as GLP-1 and GLP-1/GIP RA throughout. The benefits of these medications, from weight loss to improved insulin sensitivity, blood pressure, and lipid profiles, have been widely documented in people with prediabetes, T2D, and obesity.[17–20] While the research and therapies continue to evolve, those with T1D and the clinicians who provide their care continue to wait for indication approvals from regulatory bodies. In the absence of those trials and approvals, many people with T1D and providers have sought off-label use of these medicines as adjunctive treatment to insulin therapy.

This consensus report aims to improve care for people with confirmed T1D by providing expert opinion and evidence-based recommendations for the introduction of GLP-1 and GLP-1/GIP RAs as adjunctive therapies alongside insulin therapy for people with T1D. We focus on the use of weekly semaglutide and tirzepatide as the preferred options to incorporate into daily management and long-term care.[21–23] The recommendations outline the titration both of GLP-1 and GLP-1/GIP RAs and insulin dosing, leveraging diabetes technology to mitigate hypoglycemia, hyperglycemia, and ketosis. They also include plans for minimizing side effects that are unique to T1D and successful maintenance of these therapies for long-term reduction of diabetes-related complications. This consensus will also highlight the benefits associated with incretin therapy, such as weight loss, improved glucose management, blood pressure and lipid management, and renal risk reduction, along with overall improvement in quality of life (QoL).

Methods: Initiation of Consensus and Involvement of the diaTribe Foundation

The diaTribe Foundation is a nonprofit patient advocacy organization dedicated to educating and empowering people with diabetes. A lack of research evidence should not exclude people with diabetes from access to the best available treatment options. diaTribe convenes global experts who are

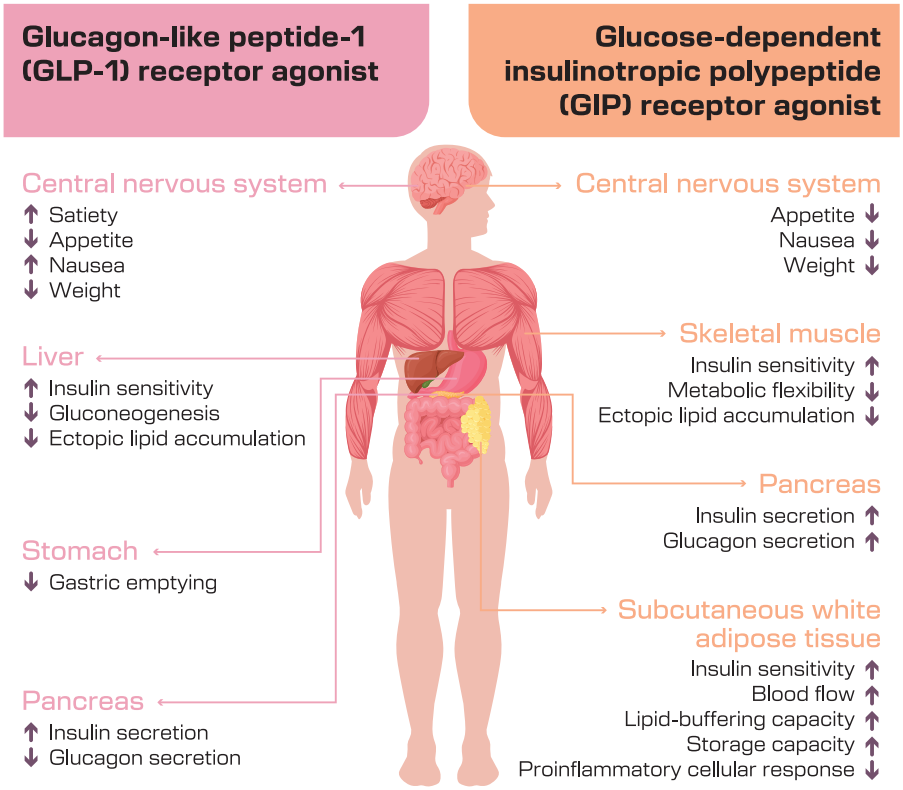

FIG. 1. Physiological actions of GLP-1 and GLP-1/GIP RA therapy for people with diabetes. The figure describes the pleiotropic effects of GLP-1 and GLP-1/GIP RA agents on the separate sites of action, as identified. The arrows indicate direction of change, an upward arrow indicates an increase in activity following initiation of GLP-1 and GLP-1/GIP RAs, and a downward arrow indicates a decrease in activity. GIP, glucose-dependent insulinotropic polypeptide; GLP-1, glucagon-like peptide 1; RA, receptor agonist.

willing to share their knowledge and expertise to bridge gaps in research and ensure knowledge is available to clinicians and people with diabetes to improve outcomes.

diaTribe invited health care professionals (HCPs) with expertise in the application of GLP-1 and GLP-1/GIP RA therapies to participate in a consensus panel that complied with the Accurate Consensus Reporting Document criteria.[24] This group of experts first met together at the annual European Association for the Study of Diabetes in Vienna, September 2025. To optimize input to the consensus process, we used the nominal group technique (NGT), combining brainstorming, discussion, and refinement of ideas.[25] NGT is designed to allow every participant to voice their views at all distinct stages and to agree or disagree within the overall group structure. Opinion leaders were drawn from academic and clinical centers across pediatric and adult diabetes, as well as gastroenterology and primary care associations globally. The writing group was selected to be multidisciplinary and included an international representation of participants. All authors of this consensus statement are members of the consensus writing group. People with diabetes (including individuals with experience of initiating GLP-1 or GLP-1/GIP RA therapy) were also invited to join the consensus group. Participation in the writing group was voluntary and not remunerated. S.K.G. and J.H. created a compendium of topics for consideration by the writing groups, who provided objective feedback on the topic areas at an online meeting on October 20, 2025. The writing groups delivered content specific to their remit on January 16, 2026. Based on the contributions of the working groups, a consolidated draft article and consensus recommendations were compiled by a medical writer. This draft was recirculated to the writing group members for their feedback, which was not restricted to their own original topic focus. All feedback was consolidated by the medical writer who also managed version control over multiple serial drafts of the article and the consensus recommendations. A final list of consensus recommendations was agreed after discussion and voting at a meeting of the author group (in person or asynchronously) at the annual Advanced Technologies and Treatments for Diabetes meeting in Barcelona, Spain, in March 2026.

Introduction of GLP-1 and GLP-1/GIP RAs in the Management of T1D

Despite the glycemic benefits of technological improvements in the effective management of intensive insulin therapy, they are also proposed to have contributed to an increased prevalence of overweight/obesity in T1D.[26] A significant emerging challenge is that more than two-thirds of people with T1D are overweight or obese.[26,27] This is contrary to previously established teaching that people with T1D are typically lean. Specifically in the United States, across all age groups, gender, and ethnicities, there has been a significant increase in overweight/obesity among people with T1D in the past decade, such that they now mirror the rates of

overweight/obesity in the general population,[28] with obesity rates in people with T1D and the general population around 40%.[29,30] Importantly, individuals with T1D and overweight/obesity are at greater cardiometabolic risk and are more prone to the development of chronic complications compared with normal-weight individuals with T1D.[31,32]

For people with T2D, noninsulin therapeutic options include metformin, dipeptidyl peptidase-4 inhibitors, sodium-glucose cotransporter 2 (SGLT2) inhibitors, and daily or weekly GLP-1 RAs and more recently, combined GLP-1/GIP dual agonists.[33] Many of these medications have been investigated in small, randomized controlled trials (RCTs), finding modest benefits in people with T1D.[34–37] Despite more than a century passing since the discovery of insulin, there remain no other approved adjunctive treatment options available for people with T1D and overweight/obesity who need improved glycemic management, glucose stability, and protection from diabetes-related complications. In the United States, the U.S. Food and Drug Administration (FDA) did approve pramlintide (an amylin analog) in 2005 as adjunctive therapy for people taking insulin; however, it has subsequently been withdrawn from the market.

More recently, there has been a considerable increase in the off-label use of SGLT2 inhibitors, GLP-1 RAs, and newer weekly GLP-1/GIP dual agonists for the glycemic management of people with T1D and overweight/obesity, and associated comorbidities.[38,39] Both semaglutide and tirzepatide are among the commonly used options for use in people with T1D.[21–23] Despite the lack of FDA approval, prescriptions for these medications are likely to increase following the recommendation to apply general population approaches to obesity management, including GLP-1 and GLP-1/GIP RAs, to people with T1D.[40]

Benefits of Treatment with GLP-1 and GLP-1/GIP RAs in T1D

Several real-world studies and a few RCTs have demonstrated significant improvements in glycemic outcomes in adults with T1D leveraging GLP-1 and GLP-1/GIP RAs. In addition, there exist several small retrospective cohort analyses on the use of GLP-1 and GLP-1/GIP RA in pediatric populations and long-term glycemic and nonglycemic benefits with these drugs in this population. Data for use of GLP-1/GIP RA in both adult and pediatric populations with T1D are presented below.

Impact of therapy with GLP-1 and GLP-1/GIP RAs in T1D adult populations

Regarding long-term efficacy of GLP-1 and GLP-1/GIP RAs in adults with T1D, Table 1 summarizes data from eight observational studies of 12–24 months duration,[22,41–47] assessing treatment outcomes for weekly semaglutide or tirzepatide in people with T1D, two of which also included participants using liraglutide or dulaglutide. Across the studies, at baseline, the participants had a mean age range of 16–46 years, mean weight of 85–104 kg, body mass index (BMI) 32–36 kg/m^2, and HbA1c of 7.0%–8.6% (53–71 mmol/mol). Mean reductions in HbA1c ranging from −0.3% to −1.1% (−3.6 to 12.0 mmol/mol) were noted after

TABLE 1. LONG-TERM (≥12 MONTHS) OUTCOMES WITH WEEKLY GLUCAGON-LIKE PEPTIDE 1 AND GLUCAGON-LIKE PEPTIDE 1/GLUCOSE-DEPENDENT INSULINOTROPIC POLYPEPTIDE RECEPTOR AGONIST THERAPY IN PEOPLE WITH TYPE 1 DIABETES

Study	*Study design*	*Agent*	*Study duration (months)*	*Number in intervention group*	*Mean age (years)*	*Baseline HbA1c (%)*	HbA1c change (%)[a]	P *value for Δ in HbA1c**	*Baseline TIR (%)*	*TIR change (%)*	P *value for Δ in %TIR**	*Baseline weight (kg)*	*Weight change (%)*	P *value for Δ in weight**
Garg[41]	Retrospective cohort study	Tirzepatide	21	84	41	7.0 ± 0.9	−0.50 ± 0.07	0.017	N/A	N/A		95.0	−23.4	<0.001
Gonzalez[42]	Retrospective cohort study	Semaglutide Dulaglutide Liraglutide	16	24 (21 using semaglutide)	16.4	8.3 ± 1.5	−0.81 (−0.04, −1.58)	0.04	50.4	+7.6	0.12	89.2	−7.6	0.02
Snell-Bergeon[22]	Retrospective cohort study	Tirzepatide	12	50	39	7.0 ± 0.2	−0.68 ± SE 0.14%	<0.05	N/A	N/A		103.7	−21.4	<0.001
		Semaglutide		50	42	7.6 ± 0.2	−0.54 ± SE 0.16%	<0.05	N/A	N/A		96.7	−9.1	<0.001
Al Ozairi[43]	Real-world study	Tirzepatide	12	35	37.4	8.3 ± 1.5	−0.65 (−0.97, −0.37)	<0.001	N/A	N/A		86.8	−11.1	<0.001
		Semaglutide	12	36	36.6	8.1 ± 1.2	−0.33 (−0.54, −0.13)	0.009	N/A	N/A		85.1	−10.0	<0.001
Garg[44]	Retrospective cohort study	Semaglutide	12	50	42	7.6 ± 1.2	−0.7 ± 0.2	<0.05	57.3	+5.1	N/S	96.9	−7.6	<0.05
Mertens[45]	Real-world study	Semaglutide	12	42	45.8	7.4 ± 0.8	−0.4 ± 0.6	<0.001	58.7	+4.5	0.156	97.4	−13.3	<0.001
Al Hayek[46]	Real-world study	Semaglutide	24	67	31.8	8.2 ± 0.5	−1.1 ± 0.4	<0.001	46	+25	<0.001	86.0	−16.3	<0.001
Almohareb[47]	Retrospective chart review	Semaglutide Liraglutide	18	141 (92 using semaglutide; 49 using liraglutide)	33.0	8.6 ± 1.4	−0.5 ± 0.8	<0.001	60.0	+17.0% (3 M)	N/S	91.5	−4.5	<0.001

**P* value for change from baseline.

[a]Change in HbA1c reported in studies with ±standard error (SE), ±standard deviation, or 95% confidence intervals.

GIP, glucose-dependent insulinotropic polypeptide; GLP-1, glucagon-like peptide 1; HbA1c, glycated hemoglobin A1c; N/A, not assessed; N/S, not significant; RA, receptor agonist; T1D, type 1 diabetes; TIR, time in range 70–180 mg/dL (3.9–10.0 mmol/L).

12–24 months. For the three studies where duration extended beyond 1 year (16, 18, and 21 months respectively),[41,42,47] reduction from baseline HbA1c ranged from −0.4% to −0.8% (Table 1). Five studies reported time in range (TIR) 70–180 mg/dL (3.9–10.0 mmol/L) changes of 4.5%–25%, equating to between 65 and 360 min of additional TIR.[42,44–47] The magnitude of weight loss was influenced by the therapy used, with participants achieving greater weight loss with tirzepatide versus semaglutide (Table 1). Most trials reported no major safety concerns. No increases in severe hypoglycemia or diabetic ketoacidosis (DKA) risk with weekly GLP-1 and GLP-1/GIP RA were reported in these observational studies.

Eighteen studies on weekly GLP-1 and GLP-1/GIP RA drugs that reported nonglycemic outcomes, including surrogate cardiovascular risk markers, are included in Supplementary Table S1. In all studies, treatment with GLP-1 and GLP-1/GIP RAs was associated with significant weight loss in adults and adolescents with T1D, with around 9% weight loss with semaglutide,[21,22,43–46,48–50] and weight loss of 10%–23% reported with the use of tirzepatide.[22,41–43,51–53] Treatment with tirzepatide was also associated with improvements in blood pressure[41,51] and lipid profiles.[41,43,51] Treatment with semaglutide has also been shown to improve blood pressure[45] and lipids.[43,45–47,54] Tirzepatide treatment is associated with decreases in daily insulin dose of up to 30%.[51,53] Although treatment with semaglutide has also been associated with decreases in daily insulin dose,[21,43,45,54] significant changes in insulin doses have not been consistently seen in all studies.[22,44,50] Weight loss with GLP-1 and GLP-1/GIP RAs is also associated with reduced obstructive sleep apnea and consequent improvements in QoL.[55]

Evidence suggests GLP-1 and GLP-1/GIP RA therapy can offer sustainable benefits for adults with T1D. A 2026 real-world study reported a significant reduction in all-cause hospitalization and all-cause mortality in a short-term 2-year follow-up study in people with T1D using GLP-1 and GLP-1/GIP RAs, compared with nonusers in a large TriNetX database.[56] There was a 44% reduction in emergency department visits, with no increase in visits for hypoglycemia or DKA. Although cardiovascular and kidney outcomes trials of GLP-1 and GLP-1/GIP RAs have excluded people with T1D, a retrospective target trial emulation used observational data from 174,678 people with T1D to mimic RCT outcomes in individuals who had initiated GLP-1 RA therapy, compared with propensity-score matched individuals not treated with GLP-1 RAs.[57] The analysis showed that among 11,648 people with T1D using GLP-1 RA agents, the 5-year hazard ratio (HR) for major adverse cardiovascular events was 0.85 (0.77–0.95) compared with nonusers, a 15% relative risk reduction. For end-stage renal disease, the 5-year rate reduction was 19% (HR = 0.81 [0.69–0.95]) for 14,218 GLP-1 RA users with T1D compared with a matched cohort of nonusers.[57] No increased risks of hospitalization for DKA or severe hypoglycemia were observed. Together, these outcomes indicate significant health care gains along with savings for health care resource utilization for people with T1D treated with GLP-1 and GLP-1/GIP RA therapy.

The few studies reporting outcomes beyond 1 year of GLP-1 and GLP-1/GIP RA therapy in adults with T1D indicate that these treatments appear to be safe and associated with maintenance of improved glycemic outcomes. Observational studies have reported significant improvements in surrogate cardiovascular risk markers in adults with T1D; however, large, randomized trials of cardiovascular outcomes in this population are greatly needed, given the high risk of cardiovascular mortality in people with T1D. Of note, the majority of studies included were retrospective and observational in nature, study designs that have many limitations including potential selection biases and under reporting of safety outcomes. The potential for down-titrating GLP-1 and GLP-1/GIP RA doses to a minimally effective dose, once treatment goals for weight loss and glycemic management are met, also requires further research. In this context, the development and maintenance of lifestyle changes that foster improved dietary behaviors and physical activity are particularly important to achieving long-term goals.

Impact of therapy with GLP-1 and GLP-1/GIP RAs in children and youth with T1D

Current evidence regarding the use of GLP-1 and GLP-1/GIP RAs in children and adolescents with T1D is relatively sparse. Trials assessing early generation GLP-1 RAs, such as exenatide, support the beneficial impact of this therapy in the pediatric population.[58] More recently, a case series of eight adolescents and young adults at a single center using a weekly GLP-1 and GLP-1/GIP RA (semaglutide or tirzepatide) demonstrated a general trend of weight reduction, decreased total daily dose (TDD) of insulin, glycemic improvement, and overall tolerability of these medications within this cohort.[59] A retrospective study on 33 youth/young adults (mean age 17.6 years) with T1D, treated with GLP-1 and GLP-1/GIP RAs, reported a mean HbA1c reduction of −0.32%, BMI reduction of −2.2 kg/m^2, TIR improvement of +11.7%, and a TDD reduction of −14.6 U/day after 12 months.[60] Another retrospective study of 24 youth with T1D, on insulin pump therapy and using GLP-1 and GLP-1/GIP RA,[42] reported significant reductions in BMI of −3.7 kg/m^2, TIR improvement of +8.0%, and TDD reduction of −21.4 U/day, after 12 months of treatment. HbA1c in this study cohort was reduced by −0.8% at 16 months. Overall, these data indicate a trend toward a benefit of GLP-1 and GLP-1/GIP RA therapy in children and adolescents with T1D and overweight/obesity, supporting the need for adequately powered RCTs to establish safety and efficacy of these agents in pediatric populations.

Initiation of GLP-1 and GLP-1/GIP RA Therapy in T1D and Concomitant Insulin Dose Titration

Initiation of GLP-1 and GLP-1/GIP RA therapy for people with T1D and overweight or obesity should align with established prescribing principles. Initiation should be considered in people with T1D and BMI ≥30 kg/m^2, without weight-related comorbidities, or with BMI ≥27 kg/m^2 and at least one weight-related comorbidity, such as hypertension, dyslipidemia, obstructive sleep apnea, or CVD. For people with persistent hyperglycemia and not meeting glycemic targets for HbA1c, despite adherence with intensive insulin therapy, a BMI <27 kg/m^2 may be considered at initiation of GLP-1 RA or GLP-1/GIP RA therapy, to achieve HbA1c reductions without increased risks of hypoglycemia. BMI should be recorded prior to initiation and monitored at each clinic visit, along with glycemic measures and insulin doses. A sustained

≥10% reduction in BMI and meeting agreed targets for HbA1c may be agreed as treatment goals to be reviewed, with adjustment of GLP-1 RA doses as appropriate. For people who achieve BMI <25 kg/m^2, or who are prescribed GLP-1 RA and GLP-1/GIP RA for glycemic management when BMI at initiation is ≤25 kg/m^2, regular reassessment is indicated with dose adjustments or a pause in treatment, as needed. For the person with T1D initiating GLP-1 RA or GLP-1/GIP RA, participation in lifestyle and nutritional education or therapy is an important component of individualized management.

Patient education and close monitoring during initiation of GLP-1 and GLP-1/GIP RA therapy

Comprehensive patient education is necessary for the safe use of GLP-1 and GLP-1/GIP RAs in people with T1D. Reduced appetite and slowed gastric emptying can also result in reduced fluid intake and unintended dehydration, potentially exacerbated by vomiting or diarrhea following initiation. Therefore, maintaining hydration is important to encourage from the moment of initiation. Unintended dehydration may also be accompanied by hypotension, which emphasizes the need for blood pressure monitoring and management of antihypertensive agents.

When initiating GLP-1 and GLP-1/GIP RA therapy in individuals with T1D, start with low doses and titrate up as tolerated. Titration can occur every 4 weeks in most cases, although some individuals may require slower increases in dosages over time. Insulin dose titration should be provided at initiation of GLP-1 and GLP-1/GIP RA therapy, with particular emphasis on recognizing hypoglycemia, hyperglycemia, and ketosis risk.[61] Written instructions for insulin self-adjustment should be provided to all individuals. Close follow-up is recommended during therapy initiation and GLP-1 and GLP-1/GIP RA dose escalation. Remote or in-person follow-up at 7 or 14 days as requested by the patient, followed by 4-week intervals during dose escalation, allows timely identification of glycemic trends and insulin dose adjustments. For people with T1D on a stable dose of GLP-1 and GLP-1/GIP RA, not requiring escalation, follow-up intervals may be every 3 months after the initial early virtual or in-person visits.

Approach to insulin dose adjustments with initiation of GLP-1 and GLP-1/GIP RA therapy

The initiation of GLP-1 and GLP-1/GIP RA therapy reduces appetite and food intake, slows gastric emptying, reduces glucagon levels, and lowers postprandial glucose excursions, along with improving insulin sensitivity and lowering glucose variability (Fig. 1). Individuals with detectable preserved C-peptide may also experience insulinotropic effects on β-cell function.[62] All of these contribute to a reduced need for exogenous insulin, with reductions in TDD of insulin of up to 25%–35% during initiation and titration of GLP-1 and GLP-1/GIP RA therapy in adults.[63,64] The limited data available for children and youth with T1D treated with GLP-1 and GLP-1/GIP RA agents suggest that reductions in TDD of insulin are of the order of 20%.[42,58] Consequently, it is crucial to adjust insulin doses during GLP-1 and GLP-1/GIP RA therapy in individuals with T1D. Inappropriate insulin adjustments may increase the risk of adverse events (AEs).[65] The ADJUNCT studies with a daily GLP-1 RA (liraglutide) in individuals with T1D showed an increased risk of symptomatic hypoglycemia and hyperglycemia with ketosis.[63,64] However, ADJUNCT ONE had a treat-to-target design for insulin throughout the trial to achieve glycemic targets,[63] and ADJUNCT TWO capped insulin doses, limiting insulin adjustment.[64] Coupled with GLP-1 RA titration, this may have influenced risks for hypoglycemia. Currently, the most used GLP-1 and GLP-1/GIP RAs in people with T1D are semaglutide or tirzepatide, in part due to weekly administration and their efficacy in weight loss. Real-world studies with semaglutide or tirzepatide have not shown a significant risk for hypoglycemia or hyperglycemia/ketosis.[21–23,41,42,44,48,52,66,67] This may be, in part, due to lessons learned from liraglutide studies, with more proactive insulin dose adjustments, use of AID systems, and use of CGM or capillary blood ketone finger-stick monitoring. Also, real-world studies may underreport instances of severe hypoglycemia or ketosis, as participants are not explicitly monitored for these events. Selection biases for GLP-1 RA prescribing could also be a factor for the absence of acute diabetes events in real-world studies. Most of the real-world studies in people with T1D (especially in younger individuals) have reported lower tolerable dose of GLP and GLP/GIP RA than what is usually recommended for people with T2D.

It is important to prioritize reductions in bolus insulin doses when starting GLP-1 and GLP-1/GIP RA therapy. Across semaglutide and tirzepatide studies using insulin pump or AID therapy, reductions in bolus insulin occurred earlier and were disproportionally greater than reductions in basal insulin.[53,54,68] This pattern likely reflects reduced food intake, delayed gastric emptying, and improved insulin sensitivity (Fig. 1). Accordingly, bolus insulin reduction should be prioritized before basal insulin reduction in most people with T1D on insulin pump or AID systems starting GLP-1 and GLP-1/GIP RA therapy. We recommend increasing insulin-to-carbohydrate ratios (ICRs) and correction factors (where applicable) for people on multiple daily injections (MDIs), insulin pump therapy, and AID systems. To reduce the necessary insulin per gram of carbohydrate (Table 2), greater increases in ICR are generally indicated initially for individuals with HbA1c <7.5% (58 mmol/mol), modest increases for people with HbA1c 7.5%–8.5% (58–69 mmol/mol), and none for those with HbA1c >8.5% (>69 mmol/mol; Table 2).

Excessive or rapid basal insulin reduction may diminish improvements in glycemic metrics and increase the risk of ketosis, particularly during periods of reduced caloric intake. Conversely, insufficient basal reduction, especially in individuals using MDI regimens, may increase the risk of nocturnal hypoglycemia. Since significant reductions in insulin needs are not always present with GLP-1 RA treatment in T1D,[22,44] aggressive reductions at initiation are not recommended. Rather, a stepwise basal insulin reduction strategy is preferred. The assessment frequency can include both virtual and in-clinic consultations, to reduce the burden on the person with T1D and their health care service. This approach balances safety with maintenance of glycemic benefit.

Table 2. Using Glycemic Measures to Monitor and Adjust Insulin Doses When Initiating Glucagon-Like Peptide 1 and Glucagon-Like Peptide 1/Glucose-Dependent Insulinotropic Polypeptide Receptor Agonist Therapy

	Adjustment for MDI		*Adjustment for AID*	
Assessment metric (baseline)	*Basal insulin*	*Bolus insulin*	*Basal insulin*	*Bolus insulin*
14-day CGM				
TIR <50% and TBR <4%	No change	No change	No change	No change
TIR 50%–60% and TBR <4%	↓ Basal by 10%	↓ Bolus by 10%	No change	↓ Bolus by 10%
TIR 60%–70% and TBR <4%	↓ Basal by 15%	↓ Bolus by 20%	↓ Basal by 10%	↓ Bolus by 20%
TIR ≥70% or TBR ≥4%	↓ Basal by 20%	↓ Bolus by 25%	↓ Basal by 15%	↓ Bolus by 25%
HbA1c				
>8.5% (69 mmol/mol)	No change	No change	No change	No change
7.5%–8.5% (58–69 mmol/mol)	↓ Basal by 10%	↓ Bolus by 10%	No change	↓ Bolus by 10%
7.0%–7.5% (53–58 mmol/mol)	↓ Basal by 15%	↓ Bolus by 20%	↓ Basal by 10%	↓ Bolus by 20%
<7.0% (<53 mmol/mol)	↓ Basal by 20%	↓ Bolus by 25%	↓ Basal by 15%	↓ Bolus by 25%

The dose changes indicate anticipated reductions in insulin doses that may be appropriate following initiation of GLP-1 and GLP-1/GIP RA therapy, in order to avoid risks for hypoglycemia. These dose adjustments reflect reduced carbohydrate intake, increased glucose-dependent endogenous insulin secretion, and increased insulin sensitivity. Insulin dose adjustments should be assessed within 2–3 days of initiation and regularly thereafter. It is important to know that individual responses differ significantly to different GLP-1 and GLP-1/GIP RA treatments, and that each person with T1D should be managed according to the principles of individualized care.

AID, automated insulin delivery; CGM, continuous glucose monitoring; MDI, multiple daily injections with insulin; TBR, time below range.

Insulin adjustment must be closely monitored and individualized. Because of anticipated weight loss and reduced food intake with GLP or GLP/GIP RA use in people with T1D, insulin dose reductions are imminent. However, unlike in people with T2D, insulin should never be discontinued for people with T1D, even for those achieving euglycemia and optimal HbA1c levels. For people with T1D using insulin pumps and AID systems, providers must emphasize that insulin sets should continue to be changed at intervals according to manufacturer instructions.

Insulin dose reassessment during and following initiation of GLP-1 and GLP-1/GIP RA therapy

Insulin regimens should be reassessed during the period of dose escalation after initiation of GLP-1 and GLP-1/GIP RA therapy, regardless of GLP-1 and GLP-1/GIP RA dose or perceived stability. Again, this can involve both telemedicine and in-clinic visits as appropriate to minimize unnecessary burdens. In people with T1D using AID systems, clinicians should understand which parameters remain adjustable in automated mode and focus on modifying settings that meaningfully influence AID, while still maintaining safe settings for manual modes in the event of CGM disruptions (e.g., connectivity or supply issues). It is well known that prandial insulin dose disproportionately goes down while on GLP-1 and GLP-1/GIP RA treatment in T1D.[63,64,69] Although no head-to-head clinical trials have compared tirzepatide and semaglutide in individuals with T1D, existing studies consistently demonstrate greater insulin dose reductions with tirzepatide, in part due to higher weight loss and GIP effects with tirzepatide (Fig. 1).[22]

In AID systems where basal insulin is automatically adapted to changes in total daily insulin dose during closed-loop function (e.g., MiniMed 780G or Omnipod 5), programmed manual basal rates may exceed actual delivered basal insulin over time with GLP-1 and GLP-1/GIP RA therapy. Manual basal settings should therefore be reviewed and adjusted to prevent hypoglycemia if the system transitions out of auto mode (e.g., situations where CGM is not used).[70] The basal insulin delivery changes over time with AID use can inform what new, lower, manual basal rates should be. However, if an individual is using an AID system in which basal insulin is used as a parameter in auto mode function (e.g., Tandem Control IQ, twiist, CamAPS FX), basal insulin dose adjustments will likely be needed in addition to changes in the ICRs.

Use of CGM for Insulin Adjustment During GLP-1 and GLP-1/GIP RA Initiation and Dose Escalation

Use of CGM is strongly recommended for all individuals with T1D receiving GLP-1 and GLP-1/GIP RA therapy. The CGM used should meet minimum standards for accuracy and performance, so that changes in insulin dosing can be made based on CGM readings alone.[71,72] Unlike HbA1c, CGM captures daily and weekly glycemic trends, making it an essential tool during GLP-1 and GLP-1/GIP RA dose escalations that commonly occur every 4 weeks. In addition, people with T1D starting GLP-1 and GLP-1/GIP RA therapy should be advised to monitor ketone levels when glucose levels are ≥200 mg/dL (≥11.1 mmol/L) for 2 h or more.[73] However, euglycemic ketosis may occur without significant hyperglycemia[74] and education on symptoms of ketosis or DKA, such as nausea, vomiting, abdominal pain, or unexplained fatigue, should also be provided. This must include awareness that symptoms of acidosis may overlap with gastrointestinal (GI) side effects of GLP-1 and GLP-1/GIP RA therapy. Understanding of "sick day" rules for when precipitating factors for ketosis may be present, such as infections, is also necessary prior to starting therapy. Individuals with T1D receiving GLP-1 and GLP-1/GIP RA therapy should also check for ketones in all these situations, whether hyperglycemia is present or not.

Based on CGM glucose data and the individual's response to GLP-1 and GLP-1/GIP RAs, the insulin dose may need to

be modified after 2–3 days following initiation (Table 2). With further GLP-1 and GLP-1/GIP RA dose escalations and weight loss (increasing insulin sensitivity), the insulin dose will need to be further adjusted (Table 2). Using CGM enables people with diabetes to self-adjust insulin doses between clinical visits, particularly with changes to appetite or eating patterns. CGM metrics such as TIR, time in tight range 70–140 mg/dL (3.9–7.8 mmol/L), and time below range <70 mg/dL (<3.9 mmol/L) or <54 mg/dL (<3.0 mg/dL) are useful in insulin dose titration. Individuals with T1D should be instructed to drink extra fluids during the GLP-1 and GLP-1/GIP RA dose escalations, to avoid dehydration because of nausea, vomiting, or other GI events during up-titration. The anticipated availability of continuous dual glucose ketone (DGK) monitoring[75–77] is also predicted to make GLP-1 and GLP-1/GIP RA treatment easier and safer for individuals with T1D. During GLP-1 and GLP-1/GIP RA dose escalations, CGM metrics should supersede HbA1c levels for insulin dose adjustments. This approach helps to reduce the risk of hypoglycemia while having adequate insulin coverage to prevent hyperglycemia and ketosis.

HbA1c-guided insulin adjustment at therapy initiation

For people with regular HbA1c test results, the use of HbA1c data at initiation of GLP-1 and GLP-1/GIP RA treatment is encouraged (Table 2). However, it is important to know that individual responses differ significantly to different GLP-1 and GLP-1/GIP RA treatments. For example, GI AEs have been shown to occur more frequently in younger adults with T1D, in those with a lower BMI, and in those with a longer duration of diabetes. Nausea may impact insulin adjustments at the start of therapy.[70,78] In addition, some individuals do not respond to lower dosages of GLP-1 and GLP-1/GIP RAs, while others may not tolerate even the starting dose. Thus, adjustment of insulin doses over the first 2–3 days when initiating or escalating GLP-1 and GLP-1/GIP RA treatment requires careful monitoring.

Recommendations

- Consider GLP-1 and GLP-1/GIP RA therapy with newer agents (e.g., semaglutide or tirzepatide) for adults living with T1D and overweight/obesity (B), and for adults with T1D and normal BMI who are not achieving glycemic target with insulin alone or who may benefit from cardiovascular or renal outcomes. (E)
- Consider GLP-1 RA therapy (semaglutide) for adolescents and young adults with T1D and overweight/obesity not achieving glycemic targets on insulin therapy alone (C) and for those with overweight/obesity who are achieving glycemic targets. (E)
- When prescribing a GLP-1 or GIP RA to someone with T1D, start a low dose and escalate slowly as tolerated. In some individuals, dose escalation every 2–3 months may be necessary rather than monthly. (B)
- Provide all individuals with T1D initiating GLP-1 and GLP-1/GIP RAs with comprehensive education on the impact of GLP-1 and GLP-1/GIP RAs on insulin dose changes following initiation, with particular emphasis on recognizing risks for hypoglycemia, hyperglycemia, and ketosis. (B)
- Provide all individuals with T1D initiating GLP-1 and GLP-1/GIP RA therapy with education on symptoms of DKA (B), including ketone monitoring equipment (capillary blood ketone testing is preferred over urine dipsticks). (E) Ketone levels should be monitored when glucose levels are ≥200 mg/dL (≥13.9 mmol/L) for 2 h or more. (B) Ketone monitoring is also required during illness, persistent GI symptoms, reduced food/drink intake, or significant insulin dose reduction, even if glucose values are <250 mg/dL (euglycemic ketosis). (B) Use of DGK monitors when available might facilitate early recognition of ketosis and prompt treatment. (E)
- When starting GLP-1 and GLP-1/GIP RA therapy for a person with T1D, provide education and written instructions for insulin self-adjustment after initiation, along with "sick day" protocols and education on symptom awareness for ketosis and DKA if food intake falls and insulin doses are reduced. (E)
- Consider reducing GLP-1 and GLP-1/GIP RA doses once treatment goals for weight loss and glycemic management are met, individualized to a minimally effective dose for each person. (E) At each stage, insulin doses should be adjusted as needed.
- At minimum, use of CGM devices is recommended for individuals with T1D on MDI and use of AID systems is preferred for glycemic management. (A) Insulin dose titration using CGM is recommended during and after initiation of GLP-1 and GLP-1/GIP RA therapy, and written instructions for insulin self-adjustment using CGM metrics should be provided to all individuals who acknowledge and are tailored to the insulin delivery regimen. (C)
- Following initiation of GLP-1 and GLP-1/GIP RA therapy, remote or in-person follow-up at a realistic frequency is recommended to ensure all potential AEs are monitored. Thereafter, remote or in-person follow-up at appropriate 4- to 8-week intervals is recommended to manage dose escalation in line with glycemic trends and insulin dose adjustments. Follow-up intervals may be every 3 months or longer once a stable dose of GLP-1 and GLP-1/GIP RA, not requiring escalation, is achieved. (E)
- Insulin regimens should be reassessed at every clinical encounter, regardless of GLP-1 and GLP-1/GIP RA dose, duration of therapy, or perceived stability. (A) Monitoring of blood pressure, lipid profiles, estimated glomerular filteration rate, and albumin–creatinine ratios are advised as standard.
- NEVER completely stop insulin in people with T1D on GLP/GIP RAs despite attaining HbA1c goals <7.0% (<53 mmol/mol) and lower. (E)
- For insulin pump or AID system users, insulin sets should continue to be changed at frequent intervals according to manufacturer instructions and as per treatment guidelines. (B)

Adverse GI Effects from GLP-1 and GLP-1/GIP RA Therapy in T1D

Treatment with GLP-1 and GLP-1/GIP RA therapy is associated with GI AEs, such as nausea, vomiting,

constipation, and diarrhea, as well as gastroparesis and gastroesophageal reflux disease (GERD), raising concerns regarding continuity of treatment and patient safety. In ADJUNCT ONE, involving 1398 adults with T1D treated with once-daily liraglutide, GI events were reported by 68.3% of participants on the highest dose (1.8 mg) and 50% on the lowest dose (0.6 mg), compared with 33.3% of participants in the placebo group.[63] The ADJUNCT TWO trial,[64] with 835 adult participants with T1D and using the same doses of liraglutide as ADJUNCT ONE, reported nausea in 49.5% and 32.2% of participants on the highest and lowest doses, respectively, compared with 16.5% of the placebo group. Vomiting was reported by 17.0% and 9.0% of participants on the highest and lowest doses of liraglutide, respectively, compared with 3.9% of the placebo group.

In the ADJUST-T1D RCT,[21] 72 adults with T1D and BMI ≥30 kg/m^2 were randomized 1:1 to once-weekly semaglutide (up to 1 mg) versus placebo with AID. Occurrence of at least one of the GI AEs indicated above was 53% in the semaglutide arm, compared with 25% in the control group. Discontinuation due to GI AEs was 5.5% in the semaglutide group. A crossover RCT comparing weekly semaglutide versus placebo in 28 adults with T1D[48] reported that GI AEs occurred in 82% of participants during semaglutide use compared with 25% during the placebo phase. Many GI events were mild, consistent with known class effects, and no severe GI AEs were reported. However, participants completing a posttrial qualitative structured interview (n = 23) indicated that nausea and fear of vomiting were barriers to accurate preprandial determination of upcoming carbohydrate intake and estimation of preprandial bolus.[79] Although objective head-to-head comparisons between the occurrence of GI events in GLP-1 and GLP-1/GIP RA therapy in T1D and T2D cannot be made, the overall event rates do not appear dissimilar for once-weekly semaglutide.[80,81]

Case reports have suggested a potential association of GI AEs with euglycemic DKA in people with T1D, as symptoms may lead individuals to forego food and accompanying prandial insulin, combined with vomit-related dehydration.[82–84] However, data from RCTs and large retrospective studies in T1D have not shown elevated rates of DKA nor severe hypoglycemia with GLP-1 and GLP-1/GIP RA use.[21,23,41,44,48,52] The crossover study discussed earlier did report episodes of recurrent euglycemic ketosis without acidosis in 2 out of 28 participants during the semaglutide phase.[48]

Real-world evidence suggests GI AEs may contribute to discontinuation of GLP-1 and GLP-1/GIP RAs in people with T1D.[45,47,64,85] However, these can be managed in many cases to support sustained use and treatment benefits for GLP-1 and GLP-1/GIP RAs. Treatment for mitigating nausea, vomiting, GERD, and gastroparesis includes antiemetics, antireflux, and promotility medications. Constipation can be managed through laxative use and increased fluid and fiber intake. Diarrhea can be managed with increasing soluble fiber intake. Starting GLP-1 and GLP-1/GIP RAs at a low dose and slowly escalating to minimize and treat GI AEs can improve tolerance and adherence to therapy. In some regions, GLP-1 and GLP-1/GIP RAs are provided in fixed dose single-use pens (one per week), with pens color coded as doses escalate. Where available, GLP-1 and GLP-1/GIP RAs injection pens may allow for multiple doses to be dialed in a stepwise fashion within the same pen, indicated by audible clicks. In each case, therapy should be initiated at the lowest dose, which is associated with minimized GI AEs. Following initiation, dose escalation should be managed according to a schedule that avoids increased GI intolerance. This will vary between individuals but may require a 2- to 3-month acclimatization period between dose titrations. A longer titration period may be needed in younger individuals with T1D, those with lower BMI, and those with diabetic kidney disease (DKD). Clinical experience indicates that GLP-1 and GLP-1/GIP RA therapy for people with T1D is often optimized at a dose below that achieved for people with T2D.

While more research is needed to better understand the specific risks for GI AEs in individuals with T1D based on type of analog, dosage, and other factors, the benefits may still outweigh risks for some individuals with support from health care teams experienced with GI AE prevention and mitigation strategies. It is also important to emphasize that GI AEs may sometimes be due to ketosis (especially if the person is unwell) due to inadequate insulin intake. This may not be associated with hyperglycemia due to GLP and GLP/GIP RA. Close monitoring of finger-stick blood ketones is recommended.

Recommendations

- Monitoring and treating GI AEs are necessary to optimize GLP-1 and GLP-1/GIP RA dose and outcomes in people with T1D and to improve adherence to these medications, (C) since GI side effects are commonly reported in people with T1D. (A)
- Exercise caution in people with T1D and gastroparesis or risks for gastroparesis (e.g., those with long-duration T1D or autonomic dysfunction), before initiating GLP-1 and GLP-1/GIP RA therapy. (B)
- Before prescribing and initiating GLP-1 and GLP-1/GIP RA therapy for someone with T1D:
  - Discuss risks (including GI AEs) and benefits of GLP-1 and GLP-1/GIP RA with each individual. (E)
  - Screen for GI symptoms such as reflux, fullness, bloating, constipation, and diarrhea. (E)
  - Diagnose and treat any GI conditions prior to starting GLP-1 and GLP-1/GIP RAs: for example, reflux, gastroparesis, and constipation. (E)

Monitoring Retinopathy and Eye Disease

It is established that rapid reductions in HbA1c are associated with early worsening of diabetic retinopathy (DR) in people with T1D, although improvement in glucose management improves DR status in the long term.[86,87] Meta-analyses of RCTs that have evaluated the efficacy of GLP-1 and GLP-1/GIP RAs in people with T2D have generally found no association between GLP-1 and GLP-1/GIP RA therapy and incident DR or progression of DR. A small association between weekly semaglutide and DR has been reported,[88–93] and in the Semaglutide Unabated Sustainability in Treatment of Type 2 Diabetes (SUSTAIN) clinical trial program, SUSTAIN-6 found an increase in DR-related complications over 24 months.[94,95] The GLP-1 RA group had a

76% increased risk for DR-related complications compared with the placebo group,[96] mostly among individuals with preexisting DR and high HbA1c prior to enrollment. Worsening of DR most often occurred during the first 16 weeks of treatment and was associated with a >1.5% magnitude of HbA1c reduction. Among six GLP-1 RA cardiovascular outcome trials, every 1% greater than average HbA1c reduction increased the natural logarithm of the odds ratio for DR by 0.77 (95% confidence interval [CI]: 0.21, 1.34; P = 0.007).[88] However, recent meta-analyses that included trials of oral or weekly semaglutide found no association with DR or DR-related complications.[97,98]

Tirzepatide has greater effects on HbA1c and weight reduction than single GLP-1 RA therapy.[99] In one large real-world T2D cohort study, tirzepatide reduced the risk of new-onset DR by 27% and did not increase the risk for a composite outcome of progressive DR.[100] One retrospective study of individuals with T1D on tirzepatide for ~1 year (n = 106) and controls matched by age, sex, and BMI (n = 85) found that new-onset DR developed similarly in cases and controls, even though the control group overall did not have reduced HbA1c levels on follow up, while those treated with tirzepatide did.[101] DR incidence was higher among individuals with a rapid HbA1c decline compared with those without, regardless of treatment assignment. Aside from DR, an increased risk of nonarteritic anterior ischemic optic neuropathy, an optic nerve disorder not limited to diabetes, may be associated with the use of semaglutide and tirzepatide in individuals with T2D, although results are conflicting.[102–109]

Although retinopathy occurring in T1D is indistinguishable from that in T2D, the results of T2D studies may not be generalizable to T1D, and risks for DR may be different in T1D. For example, individuals with T1D may have a longer duration of diabetes and a higher prevalence of DR at baseline prior to starting treatment with GLP-1 and GLP-1/GIP RAs than T2D cohorts examined in the previously discussed studies.[22,41,66]

Overall, short-term worsening of DR may occur when the magnitude of HbA1c reduction from baseline is high. Therefore, this expert consensus group recommends proactive eye examinations before and after initiating therapy with GLP-1 and GLP-1/GIP RAs in selected individuals, based on baseline HbA1c, presence of DR at baseline, DR stability at baseline, and predicted change in glucose levels with therapy. If glucose management is inadequate (HbA1c >8.5%) and any individual has concerns regarding DR, it may be wise to get an eye examination before initiating GLP-1 and GLP/GIP RA. Also, it may be prudent to go slow with GLP-1 or GLP/GIP RA dose titration due to unexpected excessive decline in HbA1c levels.

Recommendations

- A retinal examination should be considered within 12 months prior to initiating therapy with any new glucose-lowering approach, including GLP-1 and GLP-1/GIP RA therapy. For individuals without known retinopathy, evaluation with retinal imaging using artificial intelligence systems approved by regulatory agencies may be sufficient. (E)
    - A retinal examination should be considered closer to initiating GLP-1 and GLP-1/GIP RA therapy if there are clinical concerns, particularly when glucose levels are high (e.g., HbA1c or glucose management indicator [GMI] >8.5% [69 mmol/mol]) and there is an expectation of rapid reduction in glucose levels. (E)
    - If the retinal examination demonstrates active retinopathy warranting treatment, then in conjunction with an experienced eye care provider, ocular disease should be stabilized prior to initiating therapy with GLP-1 and GLP-1/GIP RA therapy. (E)
- In individuals without DR at baseline, a retinal examination should be performed within 1 year after initiating therapy with GLP-1 and GLP-1/GIP RA therapy, then follow standard American Diabetes Association (ADA) guidelines of an eye examination every 1–2 years thereafter. (E)
    - A retinal examination should be performed any time symptoms of impaired vision develop. (E)
- In individuals with active DR or recently treated active DR at baseline, earlier and more frequent retinal examinations may be indicated after initiating GLP-1 and GLP-1/GIP RA therapy. (E)
    - If the baseline glucose levels are high (e.g., HbA1c or GMI >8.5% [69 mmol/mol]) and there has been a substantial reduction during the first 3 months after initiation (e.g., HbA1c or GMI decrease by >0.5% [5.5 mmol/mol]), consider monitoring for DR progression with retinal examination after 3–4 months of initiating GLP-1 and GLP-1/GIP RA therapy. (E)
    - If initiating GLP-1 and GLP-1/GIP RA therapy in individuals with active or recently treated proliferative retinopathy or moderate to severe nonproliferative retinopathy, consider monitoring for DR progression with retinal examination after 3–4 months of initiating GLP-1 RA or GIP RA therapy, particularly if there has been a substantial reduction in glucose levels during the first 3 months after initiation (e.g., HbA1c or GMI decrease by >0.5% [>5.5 mmol/mol]). (E)

Mitigating Risks Associated with Weight Loss

Maintaining muscle mass and function is crucial to minimizing risks for falls and fractures[110,111] and impaired performance of daily activities,[112] all of which are strongly associated with morbidity and mortality as people age, with or without diabetes.[113–115] Decreased muscle mass and physical performance in people with diabetes are usually age- or disease-related but can also occur as an outcome of pharmacological treatments. However, muscle loss can happen with weight loss with or without GLP-1/GIP RA treatment. Studies on the use of GLP-1 and GLP-1/GIP RAs show a consistent pattern of 20%–40% of total weight loss for people with T2D, where attributable lean mass loss is equal to or greater than observed with weight loss from nutritional therapy alone.[116–119] In studies in T2D, although absolute lean mass falls, the relative lean mass can often stay the same or increase slightly, and muscle quality may be improved.[120]

Data assessing the extent and distribution of GLP-1 and GLP-1/GIP RA-induced weight loss in people with T1D are limited. A small 6-month RCT of liraglutide in 64 overweight/obese adults with T1D reported that fat mass loss was significant, but there was no significant change in lean mass compared with the placebo group.[121] In contrast, a second 6-month study on liraglutide in 44 adults with T1D did report that lean mass was significantly reduced compared with the placebo group ($P < 0.001$), along with fat mass.[122] When GLP-1 and GLP-1/GIP RA are combined with resistance training and adequate protein intake, losses of muscle strength and performance can be attenuated.[117,123] A novel investigational approach has combined GLP-1 RA therapy with bimagrumab, a humanized monoclonal antibody that targets type II activin receptors to promote or maintain lean mass.[124,125] When used with semaglutide over 72 weeks, substantial reductions in body weight were reported with preserved lean mass.[124] Overall, adhering to current guidelines for GLP-1 and GLP-1/GIP RA initiation is recommended, with integration of structured resistance training, along with careful nutrition.[126,127]

Managing Nutritional Deficiencies and Disordered Eating

GLP-1 and GLP-1/GIP RAs reduce appetite, slow gastric emptying, and promote early satiety (Fig. 1), reducing the quantity and quality of nutritional intake. In treatment of obesity, GLP-1 and GLP-1/GIP RAs are associated with calorific reductions of 16%–39%,[128] and people with T2D treated with GLP-1 and GLP-1/GIP RAs often fail to meet recommended intakes for protein, fiber, and several vitamins/micronutrients,[129] raising concerns for anemia, bone loss, and sarcopenia, particularly for individuals experiencing common GI AEs.[130]

Diabulimia is an acknowledged disordered eating and weight-conscious behavior in approximately 10% of people with T1D,[131] associated with missed or reduced insulin doses and higher HbA1c levels. Since careful management of insulin doses during GLP-1 and GLP-1/GIP RA initiation and titration is required, any concerns regarding diabulimia can be assessed using the Eating Disorder Examination Questionnaire.[132] For people with T1D, consider assessing diet quality within the first month of initiating GLP-1 and GLP-1/GIP RAs. For all individuals, encourage lean protein, high-soluble fiber, fruits, and vegetables, along with adequate hydration.[133] A multivitamin supplement should be recommended when intake is reduced, and nutritional status should be assessed at baseline and as part of routine care.[127]

Making Changes to Concurrent Medication

Recent FDA draft guidance outlines the clinical considerations for the metabolism of peptide drugs, and the assessment for drug–drug interactions (DDIs) when mechanisms of action may alter the pharmacokinetics of coadministered therapies.[134] To date, no clinically relevant DDIs involving metabolic enzymes or transporters have been reported for GLP-1 and GLP-1/GIP RA therapy.[135] However, GLP-1 and GLP-1/GIP RAs may induce DDIs indirectly through mechanism-based effects, most notably delayed gastric emptying (Fig. 1). While the pharmacokinetics of most orally administered drugs are not meaningfully affected, clinically significant interactions have been observed. Notably, tirzepatide administration resulted in reduced exposure to oral contraceptives,[136] with one 5 mg dose decreasing the maximum concentration and area under the curve of ethinylestradiol by 59% and 21%, respectively. The clinical implications of these exposure changes warrant further investigation. In addition, interactions between levothyroxine, a drug used to treat hypothyroidism, and oral semaglutide have been reported.[135,137] Following oral semaglutide, levothyroxine exhibited a delayed time to maximum concentration, indicating potential clinical relevance for this narrow therapeutic index drug. Close monitoring is therefore recommended when oral medications are coadministered with GLP-1 and GLP-1/GIP RAs. DDIs arising from secondary effects such as reduced fat mass or changes in glomerular filtration rate require further study.

Birth Control and Prepregnancy Planning

Limited clinical guidance exists on GLP-1 and GLP-1/GIP RA use during preconception, but effective birth control is recommended for individuals of childbearing potential when treated with GLP-1 and GLP-1/GIP RA.[138–140] By lowering mean glucose and BMI, as well as increasing TIR in individuals with T1D, GLP-1 and GLP-1/GIP RAs may reduce both obesity- and diabetes-related adverse pregnancy outcomes. Small studies have suggested GLP-1 and GLP-1/GIP RA exposure in early pregnancy may not significantly increase adverse outcomes.[141] However, the safety of GLP-1 and GLP-1/GIP RA during pregnancy has not been established, particularly on altered gestational weight gain, and thus the use of these agents during pregnancy is contraindicated at present.

A retrospective cohort study of 448 singleton pregnancies, in women with exposure to GLP-1 and GLP-1/GIP RAs in the 3 years before and 90 days after conception, was compared with a nonexposed group of 1344 women for gestational weight and other adverse pregnancy outcomes.[142] Among women with GLP-1 and GLP-1/GIP RA exposure, 84% had obesity and 23% had preexisting diabetes. GLP-1 and GLP-1/GIP RA use with prepregnancy or early pregnancy discontinuation was associated with more gestational weight gain and higher risk for adverse outcomes, including preterm delivery and hypertensive disorders of pregnancy.

Further studies are needed in women with T1D using GLP-1 and GLP-1/GIP RAs, to ascertain:

(1) optimal timing of discontinuing GLP-1 and GLP-1/GIP RA prepregnancy to mitigate weight gain and readjustment of insulin doses, (2) mitigation of weight gain during gestation after GLP-1 and GLP-1/GIP RA discontinuation, (3) if findings from studies of GLP-1 and GLP-1/GIP RA in pregnancies complicated by obesity or T2D/gestational diabetes (GDM) can be safely extrapolated to the unique concerns of an individual with T1D, and (4) if preconception weight loss associated with GLP-1 and GLP-1/GIP RA treatment in women with T1D increases the likelihood of pregnancy, as it does for women without diabetes and overweight/obesity.[143,144]

Perioperative Management

Because GLP-1 and GLP-1/GIP RA therapies slow gastric emptying, concerns have been raised about increased residual gastric content at the time of anesthesia and potential aspiration risk. Rare case reports document aspiration events in individuals taking semaglutide for weight loss, despite adherence to standard preoperative fasting guidelines,[145,146] and others have found that individuals on GLP-1 and GLP-1/GIP RAs and undergoing GI endoscopy more often present with higher preprocedure gastric volumes.[147,148] However, these associations do not confirm increased rates of perioperative AEs in larger cohorts. The recent OCULUS RCT, involving 60 adults on a stable dose of GLP-1 and GLP-1/GIP RA and scheduled for endoscopy,[149] found that individuals who paused their therapy for one dose prior to their procedure ($n = 32$) had a higher residual gastric content volume (RGV) that precluded adequate visualization during the endoscopy in 3.1% of cases, whereas participants who continued their GLP-1 and GLP-1/GIP RA therapy ($n = 28$) had RGV that precluded adequate endoscopy in 25% of cases ($P = 0.0029$). This study also concluded that withholding GLP-1/GIP-1RA for up to 13 days did not increase the risk of other AEs. Clear liquids the day prior to the procedure may mitigate the risk of clinically significant RGV regardless of GLP-1/GIP use. The ongoing OCULUS 2 RCT will prospectively evaluate the impact of GLP-1 and GLP-1/GIP RA therapy on colonoscopy bowel preparation quality.[150]

Current perioperative guidance from expert groups recommends individualized risk assessment and consideration of withholding GLP-1 and GLP-1/GIP RA before elective surgery, with suggested intervals ranging from approximately 24 h (for daily formulations) to up to 1 week (weekly formulations).[151,152] The optimal withholding period is not definitively established, and some people may still have elevated gastric residuals after extended discontinuation.[147,148] Point-of-care gastric ultrasound may be useful in identifying patients at higher aspiration risk.[152]

For people with T1D, surgical planning must balance aspiration risk with glycemic management during the perioperative period. Temporarily discontinuing GLP-1 and GLP-1/GIP RA may require careful adjustment of insulin doses and more-intensive glucose monitoring to maintain perioperative glycemic stability. To date, no studies have specifically assessed perioperative outcomes or defined optimal management strategies in people with T1D using GLP-1 and GLP-1/GIP RA. Further studies are needed to establish evidence-based protocols that address mitigation of aspiration risk and glycemic stability.

Recommendations

- Women with T1D must be advised to stop GLP-1 and GLP1/GIP RA therapy when actively trying to conceive or if pregnancy is confirmed. (C)
- Ahead of planned procedure or surgery, multiple professional societies recommend using an individualized approach, with shared decision making among individuals living with T1D, proceduralists, endocrinologists, and anesthesiologists, to stopping versus continuing GLP-1 and GLP-1/GIP RA. (E)
- Consider a clear liquid diet for 24 h before elective anesthesia/procedures in people with T1D on GLP-1 or GLP-1/GIP RA therapy to reduce residual gastric contents. If suspension of GLP-1 and GLP-1/GIP RA therapy is deemed necessary, more-intensive glycemic monitoring is recommended for people with T1D, along with insulin dose adjustment as indicated to maintain optimal glycemia. (B)
- Provide education to people with T1D on GLP-1 and GLP-1/GIP RA therapy about signs and symptoms of muscle loss or frailty. Clinical teams should assess symptoms of sarcopenia at all clinic visits and provide recommendations for resistance training and dietary protein intake as needed. (C) Muscle loss can happen with weight loss with or without GLP-1/GIP RA treatment.
- Provide education to people with T1D on GLP-1 and GLP-1/GIP RA therapy regarding adverse interactions with concomitant oral medications, such as levothyroxine and contraceptive pills, including those not specific to diabetes. Clinical teams should assess potential or suspected contraindications at all clinic visits. (C)

Patient Perspectives and Experience with GLP-1 and GLP-1/GIP RA Adjunct Therapy in T1D

People with T1D or T2D have increased risks for heart disease, stroke, retinopathy, DKD, neuropathy, and other long-term microvascular and macrovascular complications of diabetes. Despite this, people with T1D do not have access to the full range of medicines that clinicians have used to successfully reduce and prevent these risks in the management of T2D.[153] Innovations such as CGM technology and AID systems have dramatically improved the ability of people to manage the daily burden of T1D and improve their QoL. Despite the rapid evolution in diabetes care, management remains a significant challenge for millions of people with T1D who are unable to meet the glycemic goals that can mitigate risks for diabetes-related complications. Less than 30% of people with T1D or with T2D on insulin currently have a recent HbA1c test result at the target of <7.0% (<53 mmol/mol).[13,154] Despite access to knowledge, tools, resources, and means, managing glucose levels can be challenging, as life with diabetes is unpredictable. Perspectives from children and adolescents with T1D are uncommon in this context, but we provide first-person testimony from an adult with T1D in Box 1.

According to a 2025 survey of 186 individuals with T1D conducted by DiabetesMine and DDataExchange,[155] 87% were interested in GLP-1 and GLP-1/GIP RA therapy, both for weight loss and for glucose regulation, but glucose management was the primary motivation. Only 19% of respondents reported a proactive recommendation to initiate GLP-1 and GLP-1/GIP RA therapy from their diabetes HCP. This leaves people with T1D to forge their own path, with 28% reporting having to initiate the conversation with their HCP and 53% seeking access to GLP-1 and GLP-1/GIP RA products elsewhere, such as through online clinics and pharmacies or wellness centers.[155] These secondary entry points, bypassing HCPs in the prescribing process, raise concerns that people with T1D may receive GLP-1 and GLP-1/GIP RA agents, without receiving the education and clinician

Box 1. Adjunct therapy with GLP-1 and GLP-1/GIP RA for a person with T1D—a testimonial

With insulin and using an AID system, I was clinically obese and struggled to get my HbA1c below 7.0% (53 mmol/mol) until my endocrinologist prescribed adjunctive therapy with a GLP-1 RA in November 2020. As an early adopter of this therapy, it reduced my insulin requirement by almost 50% and my weight by 30%, while consistently increasing my TIR and keeping my HbA1c below 7.0% (53 mmoL/moL). Despite these dramatic improvements to my health and QoL, access to these medications has been an ongoing challenge because it has not yet received regulatory approval for people with T1D. Like many other people with T1D, I found that even with a prescription for the medication, GLP-1 and GLP-1/GIP RA therapy is not covered by health care insurance in the United States for people with T1D, with consequent financial burdens for continued access.[65]

oversight needed to properly and safely incorporate these medications into successful management plans.

The partnership between HCP and the person with T1D is critical as GLP-1 and GLP-1/GIP RAs are introduced into management safely. Each step requires communication and feedback that facilitates medication adjustments, incorporation into physical activity, mitigating AEs, ensuring nutritional requirements are met, and establishing new health goals as discussed above. The development and maintenance of lifestyle changes that foster improved dietary behaviors and physical activity are particularly important to achieving long-term goals. According to DiabetesMine's research, the lack of regulatory approval for a T1D indication for GLP-1 and GLP-1/GIP RAs and associated lack of health insurance coverage do not reflect the needs and real-world evidence of individuals with T1D who could benefit from these medications.[155]

Access and Equity for Use of GLP/GIP RAs in T1D

Beyond clinical considerations, access and equity have become central to the safe and effective use of GLP-1 and GLP-1/GIP RA therapies for people with T2D.[156] Coverage is highly variable across payers and plan types and is often restricted through prior authorization, step therapy, and indication-specific requirements. In the United States, employer-sponsored plans retain broad discretion, and many have continued to narrow eligibility or limit coverage to select indications as costs increase. Partnerships such as Lilly Direct, Novo Nordisk, and Costco are increasing access to GLP-1 and GLP-1/GIP RA therapy for those who have the means to purchase the therapy. Such cost-based and other constraints disproportionately affect people with lower socioeconomic status, thereby widening existing disparities in cardiometabolic care and risks for future complications. Paradoxically, in at least one study with 1330 participants,[156] it was found that people who met ADA-recommended criteria for GLP-1 and GLP-1/GIP RA use were less likely to receive treatment than those who did not (3.7% vs. 7.2%). In a separate study, it was found that this discordance is driven largely by socioeconomic and structural determinants of access—including insurance design, out-of-pocket costs, and related barriers that shape prescribing and uptake.[157]

Even when coverage is available, the process of managing access can create delays, interruptions, and substantial administrative burden—often falling hardest on people with lower income, limited health literacy, unstable insurance coverage, or reduced access to specialty diabetes care and diabetes technology. Use of compounding pharmacies to prepare GLP-1 or GLP-1/GIP RA agents during periods of shortage or other limitations on access can lead to increased risk of harm and should be avoided. Compounded GLP-1 RA and GLP/GIP RAs are not identical to regulatory approved products and have been associated with clinically important dosing errors and AEs.[158,159]

Coverage is also increasingly conditional and revocable. For example, some plans tie continuation to short-term eligibility rules (e.g., documentation of ongoing BMI thresholds or treatment-response milestones). As people using GLP-1 and GLP-1/GIP RA therapy lose weight and no longer meet plan-defined criteria, coverage can be withdrawn, forcing nonmedically indicated discontinuation and destabilizing care (e.g., rapid weight regains and worsening glycemia). Layered on top of these payer dynamics, supply disruption has been a real-world barrier for GLP-1 and GLP-1/GIP RA therapies. The FDA and professional drug-shortage monitors have documented supply-side interruptions affecting injectable semaglutide and tirzepatide products during the recent demand surge, with subsequent agency actions and communications as supply began to stabilize.[160] Even when a product is removed from formal shortage lists, local pharmacy availability can remain uneven—creating forced gaps in therapy, unplanned dose changes, and additional safety risks during reinitiation or switching.

From a value perspective, cost-effectiveness and budget impact must be distinguished. In people with T2D and/or associated obesity, multiple economic evaluations suggest that GLP-1 and GLP-1/GIP RA therapies are cost-effective over long-term horizons,[161] but these conclusions are highly sensitive to net price, treatment duration, and patients' baseline cardiometabolic risk. Even when long-term value appears favorable, the near-term pharmacy budget impact can be substantial—particularly when eligibility is broad—driving payer policies that restrict access to smaller, higher-risk, indication-defined subgroups (e.g., T2D with established CVD).

In contrast, for people with T1D, these agents are generally used off-label, and coverage is often denied or inconsistently approved, leaving access to depend on payer-specific exceptions, documentation, and repeated administrative appeals. To support broader coverage in patients with T1D, there is an unmet need for a rigorous value assessment of adjunctive GLP-1 and GLP-1/GIP RA therapy. This must include robust cost-effectiveness and budget impact analyses tailored to T1D populations and to real-world safety pathways (e.g., ketone monitoring and structured insulin dose adjustments). Such work will be essential to inform equitable, sustainable coverage policies that align access with clinical benefit while safeguarding against avoidable risks. Currently, two large-scale global RCT studies, SURPASS-T1D-1 and SURPASS-T1D-2,[162,163] are ongoing and may provide the evidence to support the use of GLP-1 and GLP-

1/GIP RAs in people with T1D. A practical pathway to coverage should align equity, safety, and value.

Access to GLP-1 and GLP-1/GIP RA therapy in selected individuals with T1D can be both safer and more equitable. This would provide metabolic benefits for long-term reductions in micro- and macrovascular complications of diabetes, with improved QoL that might translate into longer life expectancy for people with T1D.

Recommendations

- Provide people with T1D access to GLP-1 and GLP-1/GIP RA therapy in conjunction with the involvement of trained HCPs to ensure that treatment is accompanied by education and support that optimizes successful glycemic and weight loss outcomes. (E)
- Payers should support access to GLP-1 and GLP-1/GIP RA therapy for people with T1D who are most likely to benefit (e.g., obesity/insulin resistance and elevated cardiometabolic risk), using transparent criteria that minimize inequitable barriers. (E)
- Treatment plans should avoid nonmedically indicated discontinuation of GLP-1 and GLP-1/GIP RA therapy (e.g., loss of eligibility after weight loss or improvement in HbA1c to <7.0% [<53 mmol/mol]) and instead use clinical reassessment (benefit, tolerability, and safety events) to guide continuation decisions. (E)
- Benefit packages should limit out-of-pocket costs and reduce prior authorization for individuals with T1D prescribed GLP-1 and GLP-1/GIP RA therapy at the highest risk of being left behind (low income, unstable insurance, and limited specialty access), with proactive navigation support when needed. (E)
- Health systems and payers should implement contingency pathways for drug shortages or supply disruptions, including guidance for temporary interruptions, reinitiation, and therapeutic switching to reduce avoidable destabilization and unsafe substitution. (E)

Unmet Needs for Further Research

Several clinical parameters for use of GLP-1 and GLP-1/GIP RA agents require further investigation if this significant adjunctive therapy is to be optimized for people with T1D. These include:

- Glycemic outcomes of GLP-1 and GLP-1/GIP RA use in T1D populations in well-conducted RCTs. Two large phase III RCTs (SURPASS-T1D-1 and SURPASS-T1D-2) using tirzepatide in adults with T1D are ongoing globally.[162,163] The primary end point in both studies is improvement in glycemic markers (HbA1c) at 40 weeks, with many prespecified secondary end points.
- The minimal effective dose of GLP-1 and GLP-1/GIP RA for long-term maintenance therapy for people with T1D.
- Risk assessment for DR for people with T1D initiating therapy with GLP-1 and GLP-1/GIP RA.
- The impact of GLP-1 and GLP-1/GIP RA therapy on lean muscle mass in people with T1D and optimal nutrition management to mitigate any muscle loss or nutritional deficiencies.
- The safety and efficacy of GLP-1 and GLP-1/GIP RA therapy in people with T1D without overweight/obesity.
- Long-term interventional and observational trials on outcomes of GLP-1 and GLP1/GIP RA therapy on cardiovascular and renal outcomes for people with T1D.
- Robust cost-effectiveness and budget impact analyses tailored to T1D populations and to real-world safety pathways (e.g., ketone monitoring and structured insulin dose adjustments).

Strengths and Limitations

Strengths of our consensus report and the associated recommendations include the participation of an international panel of experts in GLP-1 and GLP-1/GIP RA therapies from the United States, Europe, and Asia, along with participation of individuals with lived experience of T1D and using GLP-1 and GLP-1/GIP RA therapy. We have also undertaken a structured search and review of the existing literature on the off-label use of GLP/GIP RAs in people with T1D. Limitations include the paucity of larger and long-term RCTs in populations with T1D and particularly studies investigating newer, weekly GLP-1 and GLP-1/GIP RAs. A limitation is that, although we have cited data from available RCTs, most of the data reviewed in T1D are from real-world retrospective or observational studies.

Conclusions

The application of GLP-1 and GLP-1/GIP RA therapies has delivered multiple significant benefits for people with T2D since their approval and introduction, including weight loss, reduced insulin resistance, better optimized glycemic management, reduced blood pressure, and improved lipid profiles. These same benefits have been widely documented in people with T1D, yet regulatory approval for use of GLP-1 and GLP-1/GIP RAs has not been forthcoming. Although additional outcomes trials are ongoing to further investigate GLP-1 and GLP-1/GIP RA agents as adjunct therapies for people with T1D, many individuals with T1D are choosing to access these agents independently. In doing so, there is an increased risk that known AEs will not be managed with support from HCPs, and important education focused on optimizing management of GLP-1 and GLP-1/GIP RA therapy may be missed. In this consensus report, we provide recommendations for safe and effective use of GLP-1 and GLP-1/GIP RA therapy for people with T1D, which acknowledges the need to manage AEs and titrate insulin doses to minimize risks for hypoglycemia, hyperglycemia, and ketosis. We believe access to GLP-1 and GLP-1/GIP RA therapies has the genuine potential to improve diabetes management for people with T1D, with consequent improvements in health care-related QoL and lowered risks of future complications.

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Authors' Contributions

The authors contributed equally to all aspects of the consensus process, both as participants in working groups framing the narrative and evidence base for using GLP-1/GIP RA agents in people with T1D and for the general discussion. In this way, all authors participated in generating the original content of the article and in providing feedback on serial drafts of the final article. All named authors meet the International Committee of Medical Journal Editors criteria for authorship for this article and have given their approval for this version to be published. S.K.G. and T.B. are the guarantors of this work and take full responsibility for the work as a whole.

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There are trials currently underway for GLP/GIPs in T1D care. There are also many therapies in development that may include T1D care. In the absence of those trial results and paired with an increasing number of T1Ds leveraging GLP/GIPs as adjunctive therapies, the authors of this article were eager to provide their experience and expertise, alongside current research, to provide recommendations on how to safely integrate semaglutide and tirzepatide in T1D management.

Search Strategy and Selection Criteria

We performed a comprehensive literature search on MEDLINE, PubMed, and the Cochrane Library, for articles published from any date up to February 9, 2026. The search strategy incorporated nested use of Boolean operators (AND/OR/NOT) to combine, expand, or limit results, selectively. Searching of titles and abstracts was done by adding [title/abstract] as a search operator with any term or cluster of terms.

Terms used: "glucagon-like peptide-1," "GLP-1," "glucose-dependent insulinotropic polypeptide," "GIP," "incretin agonist," "semaglutide," "tirzepatide," "exenatide," "liraglutide," "dulaglutide," "exenatide," "obesity," "overweight," "weight loss," "metabolic effects," "cardiovascular outcomes," "renal disease," "kidney disease," "safety," "adverse effects," "pancreatitis," "combination therapies," "precision medicine," "individualized medicine," "health economics," "type 1 diabetes," "type 2 diabetes," "insulin titration," "insulin dose," "cost-effectiveness," "health care resource utilization," "HCRU," "randomized controlled trial," "RCT," "observational study," "retrospective study."

For the purposes of study assessment, RCTs were assessed as prospective, interventional, and protocol driven. Real-world studies were those using data from routine clinical practice. Observational studies were those where no investigator assignment of treatments or outcomes was part of the design. Retrospective studies were constrained to be look-back studies of data or datasets already available.

Author Disclosure Statement

S.K.G. has received consulting fees and honoraria for participation on advisory boards for Medtronic, Roche Diagnostics. Abbott Diabetes Care, Dexcom, Novo Nordisk, Vertex, and Eli Lilly, and research grants from Eli Lilly, Novo Nordisk, Medtronic, and Dexcom. He has also received support for attending meetings or travel from Abbott Diabetes Care, Dexcom, Eli Lilly, and Novo-Nordisk. H.K.A. has received consulting fees in the form of payment to his institution from Roche, Medtronic, and Dexcom and grants or contracts from Roche, Medtronic, and Abbott, also in the form of payment to his institution. S.G. has received payment or honoraria from Ardelyx and Novo Nordisk and payments for funding to CCF from Abbott Diabetes Care, Enterra, and Atmo Biosciences. N.J.B. has received consulting fees from Medtronic MiniMed, Sanofi, and Dexcom. A.L.C. has received grant or contract payments to his institution from Dexcom, MiniMed, Abbott Diabetes, Insulet, Eli Lilly, Novo Nordisk, and Sanofi, payment to his institution from Insulet for lectures or educational events, and payments to his institution for advisory board participation from MannKind, Insulet, Novo Nordisk, Tandem Diabetes, and MiniMed. J.C. has received funding from diaTribe for medical writing, convening, and travel reimbursement for consensus meetings. J.C. has a leadership or fiduciary role with diaTribe. C.D.B. has received grants or contracts from Medtronic, Indigo Diabetes, AstraZeneca, and Boehringer-Ingelheim; consulting fees and payment or honoraria from Eli Lilly, Novo Nordisk, Insulet, and Abbott Diagnostics; and has a leadership or fiduciary role with Diabetes Liga Flanders and the Belgian Endocrine Society. K.D. has received honoraria for speaking engagements from Abbott, Dexcom, Eli Lilly, Medtronic, Novo Nordisk, and Pfizer; support for attending meetings from Medtronic and Novo Nordisk; and has participated on the Data and Safety Monitoring Board or Advisory Board for Medtronic and Novo Nordisk. F.G. has received grant payments or contracts to his institution from Eli Lilly and Roche Diabetes Care; consulting fees from Eli Lilly and Novo Nordisk; and payment or honoraria for lectures from Abbott, AstraZeneca, Boehringer-Ingelheim, Eli Lilly, LifeScan, Merck Sharp and Dohme, Medtronic, Novo Nordisk, Roche Diabetes Care, and Sanofi. F.G. has received support for attending meetings/travel from Eli Lilly and Sanofi and has participated on the Data and Safety Monitoring Board or Advisory Board for AstraZeneca, Boehringer-Ingelheim, Eli-Lilly, LifeScan, Merck Sharp and Dohme, Medimmune, Medtronic, Novo Nordisk, Sanofi, and Roche Diabetes Care. F.G. has had a leadership or fiduciary role at European Association for the Study of Diabetes/European Foundation for the Study of Diabetes and SIE and has received medical writing from Eli Lilly, Novo Nordisk, Roche Diabetes Care, and Sanofi. I.B.H. has received grants or contracts to the University of Washington from MannKind, Sequel Med Tech, COUR Pharma, and Tandem and consulting fees from Roche, Abbott, and Hagar. B.E.M. has received grants or contracts from National Institutes of Health (NIH)/National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), Jaeb Center for Health Research, and Medtronic; consulting fees and speaker honorarium from Insulet; and is part of the executive board at International Society for Pediatric and

Adolescent Diabetes and a member of the scientific planning committee for the ADA. B.E.M. has received research supplies from Dexcom and Diagnostics. C.M. serves or has served on advisory panels for Abbott, Bayer, Biomea Fusion, Boehringer Ingelheim, Dexcom, Eli Lilly, Insulet, Medtronic, Novartis, Novo Nordisk, Roche, SAB Bio, Sanofi, and Vertex and serves or has served on Speakers' Bureaus of Abbott, Boehringer Ingelheim, Dexcom, Eli Lilly, Medtronic, Novo Nordisk, Sanofi, and Vertex. Financial compensation for these activities has been received by her institution, which has also received support for her research from ActoBio Therapeutics, Medtronic, Novo Nordisk, and Sanofi. All other authors declare that there are no relationships or activities that might bias, or be perceived to bias, their work. C.B. has received speaker fees paid to the University of Colorado by Medtronic. K.N. has received payment or honoraria to their institution and themselves from Medtronic and Abbott, travel and hotel support from Advanced Technology and Therapeutics, and has participated on Data and Safety Monitoring Board for Medtronic, advisory board participation (payment to institution) for Medtronic, Convatec, Novo Nordisk, and Tandem and attending advisory board (payment to self) for Abbott Diabetes Care. K.N. has stock or stock options for Novo Nordisk and has received equipment from Dexcom, Novo Nordisk, Zealand Pharma, and Medtronic. D.N.O'N. has received material support from Abbott Diabetes Care and grants and material support from Medtronic and Insulet; has received honoraria for lectures from Medtronic and Abbott Diabetes Care; travel support from Medtronic and Dexcom; and has appeared on advisory boards for Abbott Diabetes Care, Tandem, and Roche. S.P. has received research funding from Breakthrough T1D, Leona M. and Harry B. Helmsley Charitable Trust, NIH, NIDDK, Dexcom, Inc., Medtronic MiniMed, Inc., University of Colorado and T1D Exchange, Unitio, Inc., along with payment to his institution from Dexcom as consulting fees; has received honoraria from the Children's Diabetes Foundation and the ADA and received support for attending meetings or travel from Children's Diabetes Foundation, American College of Diabetology, Breakthrough T1D and Advanced Technologies and Treatments of Diabetes Conference; has received payment for participation on a Data Safety Monitoring or Advisory Board from Sansum Diabetes Research Institute; is a board member-at-large (unpaid) at American College of Diabetology; is an unpaid Professional Practice Committee member; and is on the Pregnancy Planning Committee for Scientific Sessions at ADA. V.N.S. has received grants to his institution from Dexcom, Enable Bioscience, Zucara Therapeutics, Medtronic, Alexion, Cystic Fibrosis Foundation, Breakthrough T1D, and NIH; has received consulting fees from Eli Lilly, Roche, Embecta, Biomea Fusion, T1D Scout, and Abbott; has received payment or honoraria from Dexcom, Insulet, Tandem Diabetes Care, Medtronic, and Embecta; and has one patent planned, issued, or pending that is owned by the University of Colorado. J.L.S. received research contracts (paid to her institution) from Abbott Diabetes, Dexcom, Breakthrough A1D, Insulet, Medtronic, NIH, Provention Bio, T1D Exchange, consultancy fees (including work on advisory boards) from Abbott Diabetes Care, Cecelia Health, Insulet, MannKind, Medscape, Medtronic Diabetes, Sequel Med Tech, Start Up Health T1D Moonshot, Vertex, Ypsomed, and Zucara; has received payment or honoraria from Medscape; support for attending meetings or travel from Vertex; and has stock options in Start Up Health T1D Moonshot. J.K.S.-B. has received grants or contracts (paid to University of Colorado, Denver) from the NIH, Breakthrough T1D, and ADA; honoraria from the Translational Research Institute and the University of Washington; and support for attending meetings/travel from ADA and Advanced Technologies and Treatments for Diabetes. T.B. has served on advisory panels for Novo Nordisk, Sanofi, Eli Lilly, Astra Zeneca, Medtronic, Abbott, Pfizer, Tandem, and Roche and has received honoraria for participating in the speaker's bureaux of Eli Lilly, Novo Nordisk, Medtronic, Abbott, Sanofi, Dexcom, Aventis, Astra Zeneca, and Roche. T.B. has received research grant support from Abbott, Medtronic, Novo Nordisk, Sanofi, Novartis, Sandoz, Tandem, Slovenian Research and Innovation Agency, the NIH, Breakthrough T1D, Helmsley Foundation, and the European Union.

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Supplementary Material

Supplementary Data

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