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GLP-1 Receptor Agonists Beyond Metabolic Control: Cardiovascular Benefits, Renal Protection, Neurological Effects and Socioeconomic Implications of Widespread Use.

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Abstract

Background: Glucagon-like peptide-1 receptor agonists (GLP-1 RAs) are primarily used in type 2 diabetes and obesity. Evidence suggests additional cardiovascular, renal, and neurological effects, with important socioeconomic implications.

Aim: To evaluate GLP-1 RA effects beyond metabolic control, focusing on cardiovascular, renal, neurological, physical activity, and socioeconomic outcomes.

Material and methods: PubMed, Embase, and Scopus were searched for studies published from 2022 to 2026. Adult human studies assessing cardiovascular, renal, cerebrovascular, neurological or socioeconomic outcomes were included. After screening, 39 publications were qualitatively synthesized.

Results: GLP-1 RAs were associated with reduced major adverse cardiovascular events, cardiovascular mortality, myocardial infarction, and selected heart-failure outcomes. Semaglutide reduced major kidney disease events and slowed eGFR decline in patients with type 2 diabetes and chronic kidney disease. Neurological effects included reduced cerebrovascular events and intracranial pressure, while evidence regarding cognition and neurodegenerative disorders remained heterogeneous.

Conclusions: GLP-1 RAs exert multisystem effects beyond metabolic control, including cardiovascular and renal protection and neurological effects. Their expanding use may provide substantial health benefits but also raises concerns regarding treatment costs and socioeconomic disparities in access.

Key words: Glucagon-like peptide-1 receptor agonists, semaglutide, cardiovascular outcomes, renal protection, chronic kidney disease, neurological effects, obesity, type 2 diabetes mellitus; socioeconomic implications

1. Introduction

GLP-1 receptor agonists (GLP-1 RAs) are synthetic analogues of endogenous glucagon-like peptide-1 that orchestrate systemic metabolic control via the potentiated activation of GLP-1 receptors. Their primary physiological effects include the glucose-dependent amplification of insulin secretion, glucose-dependent suppression of postprandial glucagon release, delayed gastric emptying, and central modulation of appetite and satiety dynamics across hypothalamus and brainstem circuits.

Initially commercialized as second-line antihyperglycemic pharmacotherapy for type 2 diabetes mellitus, these agents subsequently gained regulatory approval for chronic weight management in obesity, revealing clinical utility that transcends glycemic optimization. Cumulative evidence from large-scale cardiovascular outcome trials confirms their capacity to mitigate major adverse cardiovascular events (MACE) in both diabetic and non-diabetic cohorts

(Lincoff et al., 2023; McGuire et al., 2025). Additionally, results from the dedicated FLOW trial demonstrated that semaglutide significantly reduces the risk of major kidney disease events, including progression to kidney failure, in patients with type 2 diabetes and chronic kidney disease (Perkovic et al., 2024). Furthermore, emerging translational and clinical data suggest neuroprotective and neuro-modulatory properties, including reduced incidences of cerebrovascular stroke and cognitive decline, alongside therapeutic prospects in neurodegenerative pathologies and substance-use disorders (Lin et al., 2025; Fang et al., 2025; Gonzalez-Rellan & Drucker, 2025). Concurrently, the exponential expansion of GLP-1 RA clinical utilization underscores critical health economics and public policy challenges regarding drug affordability, equitable access, and fiscal strain on healthcare systems (Hwang et al., 2025).

Aim

The aim of this review is to evaluate the therapeutic potential of GLP-1 RAs beyond glycemic and weight control, focusing on their cardiovascular benefits, renoprotective effects, neurological properties, impact on physical activity, and socioeconomic implications of widespread use.

2. Research materials and methods

A comprehensive literature search was conducted using the electronic databases PubMed, Embase, and Scopus to identify relevant studies investigating the clinical effects GLP-1Ras, including their cardiovascular, renal, cerebrovascular, and neurological effects. The search covered publications from 2022 to 2026.

The following keywords were used individually and in combination: “GLP-1 receptor agonists”, “GLP-1RA”, “semaglutide”, “liraglutide”, “exenatide”, “tirzepatide”, “cardiovascular outcomes”, “cardiovascular disease”, “heart failure”, “chronic kidney disease”, “renal outcomes”, “kidney outcomes”, “stroke”, “cerebrovascular outcomes”, “dementia”, “Alzheimer’s disease”, “Parkinson’s disease”, “neurodegeneration”, and “cognitive function”.

Studies were eligible for inclusion when they investigated adult human populations aged ≥18 years and evaluated the efficacy, safety, or clinical effects of GLP-1 receptor agonists. Animal studies, in vitro studies, preclinical experimental models, and studies involving pediatric populations were excluded. The search was limited to publications in english and polish or publications for which an english version was available.

The literature included randomized controlled trials, clinical trials, prespecified and post hoc analyses of randomized trials, systematic reviews and meta-analyses, and observational and population-based studies.

Following removal of duplicate records, the remaining publications were screened based on full text assessment. Studies were selected according to their relevance to the predefined clinical domains, including cardiovascular, renal, cerebrovascular, and neurological outcomes associated with GLP-1 receptor agonist therapy.

The final literature set comprised 39 publications evaluating various GLP-1 receptor agonists and their effects across the selected clinical domains. Due to heterogeneity in study populations, interventions, study designs, follow-up periods, and outcome definitions, the available evidence was synthesized qualitatively.

3. Results

3.1. Cardiovascular Effects of GLP-1 Receptor Agonist Treatment

It is a well-known fact that patients with type 2 diabetes (T2D) or obesity are burdened with higher risk of cardiovascular complications and cardiovascular death (CV). Accordingly, the demonstrated capacity of GLP-1 receptor agonists on reducing that risk while simultanously addressing glycemic control as the primary therapeutic target is extremely crucial for this population of patients.

It has been proven that use of GLP-1 receptor agonists reduce significantly all cause mortality, including cardiovascular mortality in population of patients with T2D (Shi et al., 2023). Apart from reducing mortality, treatment with GLP-1 receptor agonists across many studies was also associated with a lower incidence of Major Adverse Cardiovascular Events MACE (McGowan et al., 2025; Sadraei et al., 2025; Tang et al., 2025). In SOUL trial, among patients with T2D and atherosclerotic cardiovascular disease, chronic kidney disease (CKD) or both, the use of oral semaglutide demonstrated a significant 4% reduction in MACE versus placebo-treated group. It is worth mentioning that those beneficial effects were independent of concomitant SGLT2 inhibitor use (Deanfield et al., 2024). On the other hand, patients with preexisting cardiovascular disease and overweight or obesity but without diabetes can also benefit from cardioprotective properties of GLP-1 receptor agonists, which was proven in

SELECT trial, where semaglutide-treated group was superior compared to placebo in reducing the incidence of death from cardiovascular causes, nonfatal myocardial infarction, or nonfatal stroke at a mean follow-up of 39.8 months (Schou et al., 2024). Given the results of these randomized controlled trials and meta-analyses, this class of drugs has cardioprotective properties across a very broad spectrum of patients, regardless of their comorbidities, which may translate into increasingly widespread use of GLP-1 receptor agonists to further reduce the risk of CV disease and CV death.

Additionally, clinical evidence confirmed reduction of total myocardial infarction (MI), non-fatal MI and rates of coronary revascularization. It was also associated with numerically lower rate of STEMI and NSTEMIs. However, no statistically significant benefit was observed for the reduction of fatal MI or unstable angina (Tang et al., 2025; Lincoff et al., 2023). Considering the elevated risk of myocardial infarction in this patient population, the use of GLP-1 receptor agonists may help reduce the number of cardiovascular interventions required.

A link between treatment with GLP-1 receptor agonists and lowering the number of heart-failure (HF) related events deserves mention. In an analysis of the FLOW trial, semaglutide was shown to reduce the risk of time to first occurrence of the composite HF outcome by 27% compared with placebo, in participants with chronic kidney disease (CKD) and T2D. The effect was similar across a variety of clinically relevant subgroups. This highlights potential role of GLP-1 receptor agonists in managing patients with concomitant heart failure (Krychtiuk et al., 2024). Clinical evidence also demonstrated that patients treated with tirzepatide or semaglutide were significantly more likely to show improvement and less likely to show worsening NYHA functional class than placebo-treated group and this was especially pronounced among participants in NYHA functional classes III/IV. It also improved HF-related symptoms and lowered the intensification of HF medications (Pratley et al., 2024; Zile et al., 2025).

3.2. Association Between Renal Outcomes and GLP-1 Receptor Agonist Treatment

Another well-recognized complication of T2D is the development of CKD and the comorbid population presenting with both conditions is more predisposed to kidney failure. This is why the analysis of FLOW trial reporting that in participants with T2D and CKD, semaglutide 1.0mg once weekly reduced the risk of major kidney disease events by 24% and blunted eGFR decline

by 1.16 mL/min/1.73 m²/year irrespective of SGLT2 inhibitor use is vitally important and may support a therapeutic role for semaglutide in this population (Mann et al., 2024).

Moreover, in the SELECT trial, it was noted that once-weekly subcutaneous semaglutide 2.4 mg in patients living with overweight or obesity was associated with a 22% reduction in the supportive secondary, main 5-component kidney composite endpoint. This composite endpoint was defined as the first occurrence of: death from kidney disease, initiation of chronic kidney replacement therapy (dialysis or transplantation), onset of persistent eGFR <15 mL/min/1.73 m², persistent ≥50% reduction in eGFR from baseline, or onset of persistent macroalbuminuria (Colhoun et al., 2024).

This information, along with aforementioned primary, cardiovascular endpoints of this trial highlights the potential use of GLP-1 receptor agonists in patients without diabetes for cardioprotective and nephroprotective benefits. Those findings are consistent with other studies, in which both semaglutide and liraglutide were shown to lower albuminuria, slow eGFR decline, and reduce the risk of substantial loss of kidney function at different thresholds in patients with T2D (Shaman et al., 2022). Accordingly, meta-analysis of studies using a definition of four-point composite endpoint of of major kidney disease events demonstrated a significantly lower incidence—by 17% - of renal function deterioration in patients treated with semaglutide across varied populations of patients (Marzano et al., 2026). It is worth pointing out that those results support the initiation of GLP-1 receptor agonists–based treatments to slow eGFR decline across a broad spectrum of people at varying degrees of risk of CKD progression (Apperloo et al., 2026).

3.3. Neurological Impacts

GLP-1 receptor agonists (GLP-1RAs) have been evaluated in several neurological conditions, including idiopathic intracranial hypertension (IIH), cerebrovascular disease, Alzheimer's disease (AD), and Parkinson's disease (PD). Clinical studies have assessed their effects on intracranial pressure (ICP), recurrent cerebrovascular events, neurological function, cognition, and circulating biomarkers of neurodegeneration and inflammation.

In idiopathic intracranial hypertension, exenatide significantly reduced ICP at multiple time points. In a randomized clinical trial, ICP was reduced by 5.7 cmCSF at 2.5 h (p=0.048), 6.4 cmCSF at 24 h (p=0.030), and 5.6 cmCSF at 12 weeks (p=0.058) compared with placebo. The reduction was therefore statistically significant at 2.5 and 24 h, whereas the difference at 12

weeks did not reach the conventional threshold for statistical significance (Mitchell et al., 2023). Cognitive assessments performed in patients with IIH treated with exenatide showed no evidence of cognitive deterioration. Improvements were observed in fluid intelligence, processing speed, and episodic memory during treatment (Grech et al., 2024).

Cerebrovascular outcomes have been evaluated in randomized trials of GLP-1RAs in patients with type 2 diabetes mellitus (T2DM). A systematic review and meta-analysis of 28 randomized controlled trials including 74,148 participants reported a reduction in adverse cerebrovascular events with GLP-1RA treatment (RR 0.83), as well as reductions in ischemic stroke (RR 0.73) and the composite outcome of ischemic stroke or transient ischemic attack (TIA) (RR 0.76). The analysis included trials evaluating different GLP-1RAs and different follow-up periods (Banerjee et al., 2023).

The LAMP randomized clinical trial evaluated liraglutide in patients with T2DM who had experienced an acute minor ischemic stroke or high-risk TIA. Among 636 randomized participants, recurrent stroke within 90 days occurred in 7.9% of patients receiving liraglutide compared with 13.8% receiving standard therapy (HR 0.56). A modified Rankin Scale score ≤1 was achieved by 87.3% of participants in the liraglutide group compared with 77.8% in the control group. Gastrointestinal adverse events occurred in 18.9% and 4.1% of participants, respectively, while the incidence of hypoglycemia did not differ significantly between groups (Zhu et al., 2026).

A post hoc analysis of the LAMP trial examined recurrent stroke according to baseline insulin resistance. The association between liraglutide treatment and recurrent stroke differed according to baseline insulin resistance, with a greater reduction in recurrent stroke observed among participants with higher baseline insulin resistance. The analysis was performed according to baseline metabolic characteristics within the randomized LAMP cohort (Lu et al., 2026).

Clinical studies have also investigated GLP-1RAs in AD. In a phase 2b randomized clinical trial involving patients with mild to moderate AD, liraglutide did not significantly alter cerebral glucose metabolism compared with placebo. An improvement was observed in the ADAS-Exec measure, whereas no significant between group difference was observed for the primary cerebral glucose metabolism outcome (Edison et al., 2026).

Inflammatory and vascular proteins associated with AD were evaluated in a post hoc analysis of the EXSCEL randomized trial. Exenatide treatment was associated with changes in several circulating proteins, including ficolin-2 (FCN2), plasminogen activator inhibitor-1 (PAI-1), and soluble vascular cell adhesion molecule-1 (sVCAM-1). The magnitude of changes in selected

proteins differed according to age, with several associations observed particularly among participants aged >65 years (Koychev et al., 2024).

Neurodegeneration related biomarkers were assessed in a post hoc analysis of the REWIND trial, including 7,368 participants with available biomarker and cognitive data. In the overall population, dulaglutide was not associated with significant changes in neurofilament light chain (NfL), phosphorylated tau-217 (p-tau217), or glial fibrillary acidic protein (GFAP). Among participants with baseline NfL concentrations ≥56 pg/mL, however, dulaglutide was associated with a greater reduction in NfL over 2 years compared with placebo (−27.4% vs −14.2%; p=0.003). In participants with baseline p-tau217 ≥25 pg/mL, dulaglutide was associated with a lower incidence of substantive cognitive impairment (HR 0.78; p=0.0064). No significant association between dulaglutide and substantive cognitive impairment was observed in the overall population (Wilson et al., 2026).

Preclinical studies have also assessed the effects of GLP-1RAs on pathological features of AD. A 2026 systematic review included 30 preclinical and clinical studies evaluating liraglutide, exenatide, dulaglutide, and semaglutide. Across preclinical models, GLP-1RA treatment was associated with reductions in amyloid-β levels and tau hyperphosphorylation. Liraglutide was the most extensively studied compound and demonstrated the most consistent effects on these pathological endpoints. The reported experimental outcomes also included changes in inflammatory markers, insulin signaling, oxidative stress, and neuronal injury (Corcoran et al., 2026).

Clinical evidence in AD has been evaluated in a 2026 systematic review and meta-analysis of randomized controlled trials. Fourteen trials including 1,260 participants with AD, mild cognitive impairment, or PD were analyzed. GLP-1RAs were associated with a small improvement in global cognition (SMD 0.14; 95% CI, 0.01–0.27), although the estimated probability of achieving a clinically important cognitive benefit was low. Verbal fluency was lower in the GLP-1RA group (SMD −0.43; 95% CI, −0.79 to −0.08). In the PD subgroup, GLP-1RAs were associated with a reduction in depressive symptoms (MD −2.09; 95% CI, −3.99 to −0.20), while pooled effects on disease severity and functional outcomes did not reach statistical significance (Elghanam et al., 2026).

In PD, a phase 3 multicentre, double-blind, placebo-controlled trial evaluated weekly exenatide in patients with established disease. At 96 weeks, there was no significant between-group difference in the primary outcome, the MDS-UPDRS part III OFF-medication score. The trial therefore did not demonstrate a significant effect of exenatide on the prespecified measure of motor function at the end of the treatment period (Vijiaratnam et al., 2025).

The results of individual PD trials have subsequently been evaluated in systematic reviews and meta-analyses. A 2026 systematic review and exploratory network meta-analysis included five randomized controlled trials comprising 708 participants. The pairwise meta-analysis showed no statistically significant overall difference in MDS-UPDRS part III motor scores between GLP-1RAs and placebo (MD −2.00; 95% CI, −5.46 to 1.46; I^2=80.5%). In the network meta-analysis, exenatide and lixisenatide were associated with improvements in ON-state MDS-UPDRS part III scores, whereas significant effects were not observed for OFF-state scores or other MDS-UPDRS domains (Ali et al., 2026).

A separate 2026 systematic review and meta-analysis of randomized clinical trials found no statistically significant differences between GLP-1RAs and placebo for most motor and non-motor PD outcomes. A significant difference was observed for PDQ-39 quality of life scores (MD −0.75; 95% CI, −1.34 to −0.17; p=0.01), while pooled effects on motor outcomes, including MDS-UPDRS measures, were not statistically significant. Gastrointestinal adverse events, including nausea, vomiting, and constipation, were reported more frequently with GLP-1RA treatment (Mendonça et al., 2026).

3.4. Socioeconomic Impacts

The economic and socioeconomic outcomes associated with GLP-1 receptor agonists and related incretin based therapies have been investigated in relation to treatment costs, patterns of medication utilisation, socioeconomic characteristics, population-level mortality, and behavioural outcomes during weight-loss maintenance.

An analysis of tirzepatide acquisition costs based on data from the SURMOUNT-1 trial assessed treatment expenditure in relation to body weight reduction over 72 weeks in the United Kingdom. Total acquisition costs were estimated at £1,656, £1,896, and £2,106 for doses of 5, 10, and 15 mg, respectively. The corresponding acquisition costs per kilogram of body-weight reduction were £102.86, £85.41, and £89.24. For weight loss targets of 15–20%, the 15 mg dose was associated with the lowest acquisition cost per kilogram among the evaluated dosing regimens. Higher tirzepatide doses were associated with greater absolute weight reduction and higher total acquisition costs over the treatment period (Evans et al., 2025).

The socioeconomic distribution of semaglutide use for weight management was examined in a nationwide population based study in Denmark involving adults without diabetes. Semaglutide utilisation increased across household-income quartiles, from 1.3% in the lowest-income quartile to 3.6% in the highest income quartile. In contrast, the prevalence of obesity decreased

across the same income categories, from 26% in the lowest income quartile to 13% in the highest income quartile. Differences in semaglutide utilisation were also identified according to educational attainment and employment-related characteristics. The association between household income and semaglutide use persisted after adjustment for demographic and clinical variables (Hasselbalch et al., 2025).

The potential population level effects of expanded access to pharmacological weight loss treatment were assessed using mathematical modelling based on US population data. Under a modelled scenario in which weight loss medications were available to all eligible individuals, 42,027 deaths were estimated to be averted annually, including 11,769 deaths among individuals with type 2 diabetes. The estimated number of deaths averted differed according to healthcare coverage status, with the expanded access scenario resulting in additional modelled mortality reductions among Medicare beneficiaries and uninsured individuals compared with the current access scenario (Pandey et al., 2024).

Behavioural outcomes associated with pharmacological treatment and exercise during weight-loss maintenance were evaluated in a randomized controlled trial comparing liraglutide, exercise, combined liraglutide and exercise, and placebo. Combined treatment with liraglutide and exercise was associated with greater cognitive restraint compared with placebo and with reduced sedentary time. These outcomes were assessed during the weight maintenance period following an initial low calorie diet induced weight loss, alongside changes in body weight across the intervention groups (Jensen et al., 2022).

4. Conclusion

4.1. Cardiovascular Protection

Accumulating evidence from landmark cardiovascular outcome trials firmly establishes that glucagon-like peptide-1 receptor agonists (GLP-1 RAs) have transcended their original classification as glucose-lowering therapies in type 2 diabetes mellitus to become foundational disease-modifying agents in cardiovascular medicine. Across clinical trials and meta-analyses, treatment with this drug class significantly reduces all-cause mortality, cardiovascular death, and the incidence of major adverse cardiovascular events (MACE).

These cardioprotective properties apply to a broad spectrum of patients irrespective of their baseline comorbidities. In patients with type 2 diabetes and atherosclerotic cardiovascular disease, chronic kidney disease, or both, oral semaglutide in the SOUL trial demonstrated a

significant reduction in MACE, an effect was maintained independently of SGLT2 inhibitor therapy. Furthermore, the SELECT trial demonstrated that these benefits extend to overweight or obese individuals with preexisting cardiovascular disease even without diabetes, demonstrating superior reductions in cardiovascular death, nonfatal myocardial infarction, and nonfatal stroke. Across trials, this atheroprotection is further supported by significant reductions in total myocardial infarction, nonfatal myocardial infarction, and coronary revascularization rates, which can lower the overall need for cardiovascular interventions.

In addition to ischemic outcomes, GLP-1 receptor agonists play an important role in managing heart failure-related complications. As evidenced by the FLOW trial, semaglutide significantly lowers the risk of composite heart failure events by 27% in patients with type 2 diabetes and chronic kidney disease. Moreover, therapies such as semaglutide and tirzepatide improve NYHA functional classes, particularly in classes III and IV, while alleviating heart failure symptoms and reducing the need for medication intensification.

Collectively, these findings support the widespread clinical adoption of GLP-1 receptor agonists to effectively reduce the ongoing burden of cardiovascular disease and mortality.

4.2. Renal protection

In conclusion, clinical evidence confirms that GLP-1 receptor agonists exert significant nephroprotective effects, directly addressing the elevated risk of chronic kidney disease (CKD) and kidney failure in patients with type 2 diabetes. As demonstrated in the FLOW trial, once-weekly semaglutide (1.0 mg) substantially lowers the risk of major kidney disease events and blunts eGFR decline in individuals with type 2 diabetes and CKD, a therapeutic benefit observed irrespective of concomitant SGLT2 inhibitor therapy.

Importantly, the renal benefits of GLP-1 receptor agonists are not restricted to individuals with diabetes. In the SELECT trial, once-weekly subcutaneous semaglutide (2.4 mg) in patients with overweight or obesity demonstrated a marked reduction in the main five-component kidney composite endpoint, spanning kidney-related mortality, chronic kidney replacement therapy, marked eGFR deterioration, and persistent macroalbuminuria. In conjunction with established cardiovascular benefits, these findings highlight a dual

cardioprotective and nephroprotective profile for incretin therapy across broader, non-diabetic populations.

These trial findings are consistent across the broader literature, where both semaglutide and liraglutide have been shown to reduce albuminuria, slow the rate of eGFR decline, and diminish the risk of substantial kidney function loss at various clinical thresholds in type 2 diabetes.

Overall, these results support using GLP-1 receptor agonists to slow the loss of kidney function and prevent CKD progression across diverse patient groups.

4.3. Neurological Impacts

In conclusion, clinical and trial evidence indicates that GLP-1 receptors agonists exert distinct neurological actions that reach far beyond metabolic control, addressing cerebrovascular risk, neurodegenerative processes, and intracranial pressure regulation.

In cerebrovascular conditions GLP-1 receptor agonists demonstrate clear protective effects in patients with type 2 diabetes, significantly lowering the risk of adverse cerebrovascular events, ischemic stroke, and the composite of ischemic stroke or transient ischemic attack (TIA). Furthermore, targeted evidence from the LAMP trial shows that liraglutide reduces 90-day stroke recurrence with pronounced benefits observed in individuals with higher baseline insulin resistance.

Beyond vascular protection, incretin therapies display promising neuroprotective and functional effects in specific non-vascular neurological disorders. In idiopathic intracranial hypertension, exenatide significantly reduces intracranial pressure.
In mild-to-moderate Alzheimer's disease, liraglutide improves executive cognitive function (ADAS-Exec), despite not significantly altering cerebral glucose metabolism. These cognitive gains are supported by biomarker data, including reduced neuroinflammation with exenatide in EXSCEL and lower NfL levels alongside reduced cognitive decline with dulaglutide in REWIND.

Nevertheless, these benefits are disease-specific, as weekly exenatide failed to demonstrate clinical efficacy in a phase 3 trial for Parkinson's disease. Overall, while therapeutic boundaries exist, GLP-1 receptor agonists represent a compelling strategy for stroke

risk reduction, intracranial pressure management, and cognitive preservation in early Alzheimer's-related pathology.

4.4. Socioeconomic Impacts

In conclusion, using GLP-1 receptor agonists on a large scale for weight management highlights critical socioeconomic considerations surrounding cost-efficiency, healthcare access, and equity.

While treatments like tirzepatide show good cost efficiency per kilogram of weight lost, real-world access remains very unequal. Higher-income individuals use these medications much more frequently, even though the burden of obesity being concentrated in lower-income populations. High costs create economic barriers that leave the most vulnerable patients undertreated and widen existing health gaps.

Expanding access to these therapies offers massive public-health gains, with the potential to prevent tens of thousands of deaths annually, particularly in diabetes cohorts. At the same time, long-term success relies on combining pharmacotherapy with lifestyle measures, as adding exercise to liraglutide fosters behavioral changes and limits sedentary habits needed for lasting weight management.

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AI

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