5 Muskiet MHA, Tonneijck L, Smits MM, et al. GLP-1 and the kidney: from physiology to pharmacology and outcomes in diabetes. *Nat Rev Nephrol* 2017; **13:** 605–28.

6 Kusminski CM, Perez-Tilve D, Müller TD, DiMarchi RD, Tschöp MH, Scherer PE. Transforming obesity: the advancement of multi-receptor drugs. *Cell* 2024; **187:** 3829–53.

7 Aronne LJ, Horn DB, le Roux CW, et al, and the SURMOUNT-5 Trial Investigators. Tirzepatide as compared with semaglutide for the treatment of obesity. *N Engl J Med* 2025; published online May 11. https://doi.org/10.1056/nejmoa2416394.

8 Frías JP, Davies MJ, Rosenstock J, et al, and the SURPASS-2 Investigators. Tirzepatide versus semaglutide once weekly in patients with type 2 diabetes. *N Engl J Med* 2021; **385:** 503–15.

9 Rayner CK, Horowitz M. Twincretin therapy for type 2 diabetes: how do two do? *Lancet* 2021; **398:** 560–61.

10 Campbell JE. Targeting the GIPR for obesity: to agonize or antagonize? Potential mechanisms. *Mol Metab* 2021; **46:** 101139.

International Federation for the Surgery of Obesity statement on metabolic bariatric surgery after pharmacotherapy-induced weight loss in clinical obesity

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Clinical obesity is a chronic systemic disease characterised by alterations in the function of tissues, organs, physical ability, or a combination of these due to excess adiposity, which can increase morbidity and mortality, and reduce quality of life.[1] Understanding the chronic nature of this disease is key to implementing sustainable, personalised treatment strategies. This statement, developed by the International Federation for the Surgery of Obesity (IFSO), addresses the emerging challenge of reassessing surgical eligibility in the context of pharmacotherapy-induced weight loss. The most effective options for weight management include obesity management medications (OMMs) and metabolic bariatric surgery (MBS) complemented by healthy nutrition and regular physical activity.[2] Although both OMMs and MBS are effective when combined with ongoing support for healthy lifestyle practices, pharmacotherapy typically requires ongoing, lifelong use, whereas MBS can offer the advantage of a potentially single but durable intervention. Specifically, we propose practical principles to guide surgical eligibility after weight loss with OMMs, and also outline how OMMs and MBS can be integrated across the disease continuum, alongside key research and policy priorities.

OMMs have been shown to lead to clinically meaningful weight loss and health improvements when used continuously.[3] However, the STEP 4 and SURMOUNT 4 trials show that discontinuing these therapies often leads to recurrent weight gain and the recurrence of complications, underscoring obesity's chronic, heterogeneous nature and the need for sustained treatment.[4,5] For individuals who are unable to tolerate or adhere to pharmacotherapy or prefer a single intervention, MBS offers a durable, evidence-based alternative. MBS provides sustained weight loss and metabolic improvement and mitigates biological drivers of recurrent weight gain.[2]

Withdrawal of an effective OMM solely to test surgical eligibility is generally unwarranted, as shown by substantial recurrent weight gain and metabolic relapse when therapy is stopped.[4,5] Surgical candidacy should be assessed comprehensively and should consider baseline pre-OMM anthropometric measures and the

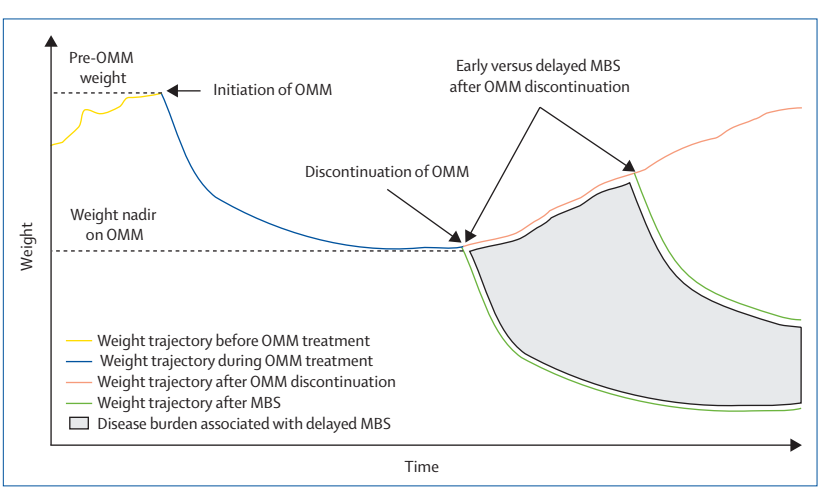

Figure: **Expected weight trajectories when MBS is performed at the time of OMM discontinuation or delayed until weight regain is established**
The figure highlights the potential additional disease burden associated with delayed MBS (grey area) after successful weight reduction with OMM. People living with obesity typically continue to gain weight as the disease progresses (yellow line), a trajectory that is reversed when treated with highly effective OMMs (blue line). When OMMs are discontinued, weight gain resumes and it is projected that most of the weight lost during treatment is regained within the next 1–3 years while off treatment (red line). MBS is successful at any disease stage (green line); however, delaying MBS until weight regain is established increases the weight-related disease burden. OMM=obesity management medication. MBS=metabolic bariatric surgery.

burden of obesity-related complications (figure).[6] While substantial preoperative weight loss achieved with pharmacotherapy can reduce surgical complexity and perioperative risk,[7] it should not disqualify patients from MBS if their clinical risk profile still warrants intervention. A high clinical risk can include persistent or severe obesity-related complications (eg, type 2 diabetes, metabolic dysfunction-associated steatotic liver disease, or hypertension), poor quality of life, or high likelihood of recurrent weight gain if pharmacotherapy is discontinued. Considering high clinical risk profiles ensures that individuals benefiting from OMMs are not excluded from surgical options due to improvements that might be transient if pharmacotherapy is withdrawn (figure). Guidelines for MBS eligibility emphasise a comprehensive, individualised evaluation that incorporates physical health, psychological wellbeing, quality of life, and risk–benefit assessment.[3] Surgical eligibility should reflect the chronic and relapsing nature of obesity and support equitable access to care. Medical therapy and surgery should be seen as complementary strategies, not mutually exclusive,[6] with treatment evaluation made by shared decision making between patients and their health-care team based on long-term goals, preferences, and clinical context.

From a health-care systems perspective, MBS offers long-term cost savings by reducing obesity-related complications, typically reaching cost neutrality within 4–6 years.[8] OMMs have lower upfront costs but require lifelong use, resulting in higher long-term expenditures. As such, at current costs, MBS can be a more cost-effective treatment option than OMMs when its value is assessed long term (>5 years).[8] Recent analyses show that MBS is economically dominant in a UK model,[9] whereas US data estimates incremental cost-effectiveness ratios of US$197 000 per quality-adjusted life year for tirzepatide and $467 000 per quality-adjusted life year for semaglutide—well above standard thresholds.[10] Thus, despite the clinical benefits, these drugs require considerable price reductions to rival the long-term cost-effectiveness of MBS.

Withholding MBS from individuals with considerable weight loss from OMM therapy and thereby no longer meeting traditional eligibility criteria raises important ethical concerns. Health-care professionals are responsible for prioritising patient autonomy, safety, and overall quality of life. Requiring patients to regain weight after successful treatment with OMMs solely to requalify for surgery unnecessarily exposes them to avoidable health risks and conflicts with the principles of good medical practice. Respecting the autonomy of patients who prefer surgical intervention instead of lifelong medical treatment aligns with the core principles of patient-centred care. Providers should, therefore, preserve these benefits rather than inadvertently compromise them with restrictive eligibility practices. The interval between the termination of pharmacotherapy and performing MBS should still be determined from careful studies and personalised analysis. At present, evidence supporting MBS in individuals with substantial OMM-induced weight loss remains scarce. Therefore, MBS in this context should be considered only after thorough multidisciplinary evaluation and clear communication of the clinical uncertainties involved. Meanwhile, advocacy efforts should continue to focus on expanding access to MBS and OMMs for the many patients with considerable disease burden who remain untreated.

A legitimate concern is unnecessary surgery in a minority of individuals who might sustain the weight loss benefits after OMM discontinuation. This problem underscores the need for individualised assessment that integrates current threshold and lifetime weight trajectory, previous treatment responses, health burden, and risk of relapse. In patients with a BMI of 25–30 kg/m^2, limited surgical data demand careful selection and full awareness of follow-up and nutritional needs. A clear risk–benefit discussion is essential, especially for preclinical obesity, given the lower disease burden, surgical risks, and rapidly advancing pharmacotherapies. Recognising obesity as a chronic, relapsing disease, MBS eligibility should reflect long-term clinical risk rather than temporary weight metrics, thereby aligning with ethical, patient-centred, evidence-based care.

There is considerable variation in treatment response after both MBS and OMMs, mainly due to the heterogeneity of the disease. Extreme obesity, a state in which the burden of excess adiposity continues to significantly affect health or functionality, could persist after active treatment due to: (1) initial suboptimal clinical response, (2) high baseline BMI despite a good clinical outcome with either approach, or (3) recurrent weight gain during follow-up after initial good response. Obesity treatment should follow the

principles of chronic disease management, which entails combining multiple potentially synergistic or additive treatment approaches when treatment goals are not met or when the disease progresses, involving clinical or surgical options, without implying failure or hierarchy.[3]

Specific studies will be required to understand if there is a minimum weight threshold to satisfy before MBS can be performed. Moreover, another important question would be whether the type of surgery should be decided based on the initial clinical evaluation or whether a less invasive procedure should be considered in patients with substantial weight loss with OMMs. Conversely, OMMs are becoming cheaper, more effective, and safer; surgical risks should continue to decline to remain competitive.

Ongoing research should report weight loss outcomes from the highest pre-intervention weight, particularly in people with substantial weight loss with OMMs before MBS. Further understanding of various disease phenotypes enables global uniform criteria for evaluating treatment outcomes,[2] thus optimising phenotype-tailored multimodal treatment. These recommendations represent an expert consensus of 15 members of IFSO's Scientific Committee, formed by surgeons, endocrinolgists, and nutritionists (appendix pp 1, 2). This group reviewed and approved the current statement, extrapolated from the current evidence. Prospective trials and health-economic studies are urgently needed to refine eligibility thresholds and sequencing algorithms.

In conclusion, current guidelines[3] and clinical evidence suggest that MBS is an effective and safe treatment option for patients who have substantial weight loss using OMMs but cannot continue this treatment. Acknowledging that obesity is a chronic disease necessitates the integration of MBS as part of a comprehensive, sustainable weight management strategy. The decision to pursue MBS after successful weight loss using OMMs should include an assessment of the disease history and the current disease state, including the risk of recurrence of obesity-related complications, pre-treatment BMI, or the persistence of clinical obesity.

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See **Online** for appendix

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1 Rubino F, Cummings DE, Eckel RH, et al. Definition and diagnostic criteria of clinical obesity. *Lancet Diabetes Endocrinol* 2025; **13:** 221–62.
2 Perdomo CM, Cohen RV, Sumithran P, Clément K, Frühbeck G. Contemporary medical, device, and surgical therapies for obesity in adults. *Lancet* 2023; **401:** 1116–30.
3 Lingvay I, Cohen RV, Roux CWL, Sumithran P. Obesity in adults. *Lancet* 2024; **404:** 972–87.
4 Rubino D, Abrahamsson N, Davies M, et al. Effect of continued weekly subcutaneous semaglutide vs placebo on weight loss maintenance in adults with overweight or obesity: the STEP 4 randomized clinical trial. *JAMA* 2021; **325:** 1414–25.
5 Aronne LJ, Sattar N, Horn DB, et al. Continued treatment with tirzepatide for maintenance of weight reduction in adults with obesity: the SURMOUNT-4 randomized clinical trial. *JAMA* 2024; **331:** 38–48.
6 Cohen RV, Busetto L, Levinson R, et al. International consensus position statement on the role of obesity management medications in the context of metabolic bariatric surgery: expert guideline by the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO). *Br J Surg* 2024; **111:** znae283.

7 Arterburn DE, Telem DA, Kushner RF, Courcoulas AP. Benefits and risks of bariatric surgery in adults: a review. *JAMA* 2020; **324:** 879–87.
8 Noparatayaporn P, Thavorncharoensap M, Chaikledkaew U, Bagepally BS, Thakkinstian A. Incremental net monetary benefit of bariatric surgery: systematic review and meta-analysis of cost-effectiveness evidences. *Obes Surg* 2021; **31:** 3279–90.
9 Capehorn M, Johansson E, Davies A, et al. EE117 cost-effectiveness of tirzepatide versus semaglutide (both adjunct to a reduced-calorie diet and increased physical activity) in patients with obesity or overweight from a UK perspective. *Value Health* 2024; **27:** S77.
10 Hwang JH, Laiteerapong N, Huang ES, Kim DD. Lifetime health effects and cost-effectiveness of tirzepatide and semaglutide in US adults. *JAMA Health Forum* 2025; **6:** e245586.

Continuous ketone monitoring for diabetes: a new era for diabetes


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Ketone monitoring has long been crucial in the management of individuals with diabetes, especially in the prevention of diabetic ketoacidosis, a potentially life-threatening complication. Yet, real-world engagement with current methods for ketone testing are suboptimal. However, a new frontier is emerging with the development of continuous ketone monitoring, which promises to reshape our understanding of diabetes and our management approach.

Despite clinical guidelines from leading diabetes societies advising that people with diabetes should check ketone concentrations during illness or during sustained hyperglycaemia that does not respond to treatment with insulin,[1,2] translation of this guidance into clinical practice has been challenging. Currently, there are two primary methods to measure ketones: urinary acetoacetate or capillary measures of β-hydroxybutyrate with a blood ketone meter. Barriers to ketone assessments are multifactorial. With the advent of continuous glucose monitors, fewer individuals with diabetes carry glucometers and acceptance of capillary testing is waning. Although urinary assessments are assumed to be easier than capillary testing, they do not measure the predominant ketone body in diabetic ketoacidosis and finding facilities to take a test in can be cumbersome. Furthermore, it is recommended to only use urine ketone strips for 30 days after opening, due to risk of deterioration of performance and potential false negative results.[1] Suboptimal, or an absence of, coverage for ketone testing supplies combined with a lack of awareness that past negative ketone results do not eliminate future risk, often leads individuals to neglect obtaining or using ketone tests. In 2017, two-thirds of adults with type 1 diabetes older than 26 years reported never checking for ketones, regardless of whether they were vomiting or had hyperglycaemia.[3] Yet the benefits of checking for ketones are clear. In a randomised trial of blood versus urine ketone monitoring, use of capillary assessments was associated with increased engagement in regular monitoring (90% with capillary assessment versus 61% with urinary measures) during acute illness and was associated with a 50% reduction in the number of emergency room visits and hospitalisations.[4] Furthermore, adolescents with type 1 diabetes who have elevated A1c concentrations might have frequent ketosis due to missed insulin doses, and scheduled ketone checks have been used to improve detection.[5] Earlier identification of ketonaemia is key as it allows for implementation of diabetic ketoacidosis mitigation plans.

Continuous ketone monitoring will build on the principles of continuous glucose monitoring technology, allowing for passive data collection without the need for the individual to remember to manually test. Importantly, the integration of a dual biosensor will reduce burden because one device will provide data on interstitial glucose and β-hydroxybutyrate concentrations. Whereas current clinical guidelines recommend reassessing ketone concentrations as often as every 1–2 h,[1] real-time ketone data show how ketone concentrations change with treatment.[1] Continuous ketone monitoring could be particularly advantageous for people with type 1 diabetes who have recurrent episodes of diabetic ketoacidosis, consistently do not reach glycaemic targets for A1c (<7%), frequently omit insulin doses, or a combination thereof. Early detection and treatment of hyperketonaemia before impending diabetic ketoacidosis might not only reduce morbidity

For more on **dual biosensors** see https://www.abbott.com/corpnewsroom/strategy-and-strength/abbotts-biowearable-one-sensor-for-glucose-ketones.html