



Review Article

Public Interest in the Off-Label Use of Glucagon-like Peptide 1 Agonists (Ozempic) for Cosmetic Weight Loss: A Google Trends Analysis

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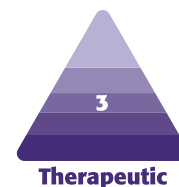
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Abstract

Glucagon-like peptide 1 (GLP-1) agonists are a drug class used for the treatment of diabetes that have recently gained FDA approval for medical management of obesity. The off-label use of Ozempic (Novo Nordisk, Bagsværd, Denmark), the brand name of the GLP-1 agonist semaglutide, for cosmetic weight loss has been popularized by social media and celebrity influence. The aim of this study was to analyze with Google Trends (Alphabet Inc., Mountain View, CA) the recent search popularity of Ozempic and related GLP-1 agonists. The term “Ozempic” was analyzed with Google Trends. Search popularity was assessed in terms of relative search volume (RSV) over a 5-year period. Changes in RSV were further compared with other GLP-1 agonists, “Wegovy” (Novo Nordisk) and “Mounjaro” (Eli Lilly and Company, Indianapolis, IN). Between March 2018 and February 2023, overall RSV in “Ozempic” grew exponentially in the United States. Simple linear regression analysis showed significantly increased RSV over time with an R^2 of 0.915 and a regression coefficient of 0.957 ($P < .001$). When comparing “Ozempic,” “Wegovy,” and “Mounjaro” since June 2021 (FDA approval of Wegovy), Ozempic remained at the greatest RSV. One-way analysis of variance found statistically significant differences between the 3 search terms at all time points between December 2021 and February 2023 ($P < .001$). This study demonstrates a significant and growing public interest in Ozempic and related GLP-1 agonists. As the use of GLP-1 agonists for weight loss becomes more prevalent, plastic surgeons, particularly in the aesthetic setting, must be prepared for the downstream implications. Increased awareness, understanding, and further scientific studies led by plastic surgeons will help deliver the safest possible patient outcomes.

Level of Evidence: 3

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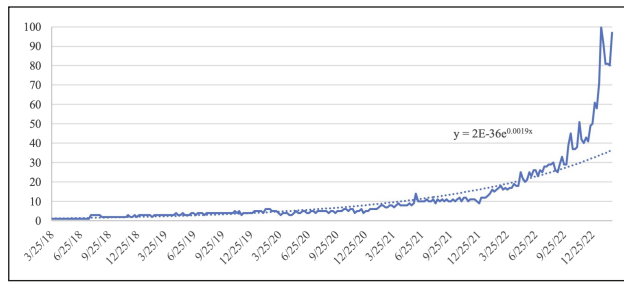


Figure 1. Relative search volume of the term “Ozempic”—March 2018 to February 2023.

Celebrity and social media influences largely shape aesthetic trends in today’s society. Changing demands for aesthetic and plastic surgeries based on these influences have been repeatedly demonstrated.¹⁻¹² Beyond the surgical field, this influence extends to the pharmaceutical choices of the public. A particular medication, best known under the brand name Ozempic (Novo Nordisk, Bagsværd, Denmark), has gained a rise in popularity with significant surrounding hype among celebrities, social media influencers, and news outlets. Ozempic belongs to a class of medications known as glucagon-like peptide 1 (GLP-1) agonists. GLP-1 agonists are most often used for the treatment of type 2 diabetes (T2DM) by way of suppressing glucagon secretion and enhancing the satiating effects of the naturally occurring GLP-1 hormone. This drug class includes semaglutide (Ozempic and Wegovy; Novo Nordisk), tirzepatide (Mounjaro; Eli Lilly and Company, Indianapolis, IN), liraglutide, exenatide, and many others.

Although Wegovy is an FDA-approved drug for weight-loss management in those with obesity, Ozempic, a “sister” semaglutide, is only FDA-approved for the management of T2DM. Nevertheless, the off-label use of Ozempic for cosmetic weight loss has become increasingly publicized and even glorified by social media and numerous media outlets. Rising popularity and interest in this drug have led to ongoing shortages of Wegovy and Ozempic, impacting patients requiring these medications for the management of their T2DM. “Ozempic parties” and “Ozempic face” have become common terms in the media, and patients are turning to aesthetic providers in large numbers for treatment and recommendations.^{13,14}

The use of GLP-1 agonists is still a relatively novel therapy in the aesthetic surgery community, and there is a paucity of scientific understanding of its implications and utilities for cosmetic indications. As such, greater understanding of this medication is needed among plastic surgeons who will increasingly be faced with patients desiring GLP-1 agonists for cosmetic weight loss or sequelae of “Ozempic face.” Although media outlets have widely reported on this topic, a comprehensive formal study of the public interest and popularity of GLP-1 agonists,

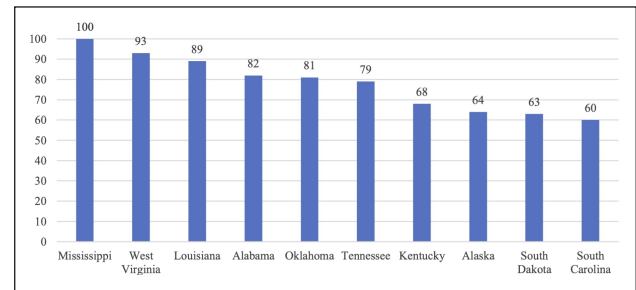


Figure 2. Relative search volume of the term “Ozempic” among states—March 2018 to February 2023.

namely Ozempic and similar agents, has not been published.

Google Trends (Alphabet Inc., Mountain View, CA) has become a notable web tool for assessing online healthcare behaviors and public interest.^{15,16} Here, Google Trends was utilized to explore the recent search history of the most popular GLP-1 agonists over a 5-year period and to analyze the rising popularity of and interest in Ozempic and related drugs for the off-label use of cosmetic weight loss.

METHODS

Google Trends (<http://google.com/trends>) is an open online search tool that analyzes the popularity of web searches over a certain period of time.¹⁷ This can serve as a surrogate marker for relative public interest in search terms, as evidenced by numerous studies.^{6,11,18} A relative search volume (RSV) is calculated by the normalized volume of a particular search interest during a particular time and location compared to all searches at the same time and location. The RSV is then scaled from 0 to 100 as an interest index, with 100 representing peak popularity of the search for the selected period and location.¹⁷

The term “Ozempic” was selected as this was the term most publicized in social media and web/print sources on this topic.¹⁹ A comparison search was conducted for Ozempic’s “sister” semaglutide, using the term “Wegovy,” and for another new combination GLP-1 agonist, tirzepatide, using the term “Mounjaro.”²⁰ All search parameters were limited to include only searches within the United States. Data were analyzed over a 5-year period from March 2018 to February 2023. The data were further evaluated over a shorter period subset that corresponded with major calendar events that popularized “Ozempic” searches, beginning with the FDA approval of Wegovy as a weight-loss management drug in June 2021. The first major media publications were in November 2022. The final time point was set as February 2023, corresponding with current searches regarding “Ozempic,” “Wegovy,” and “Mounjaro.”

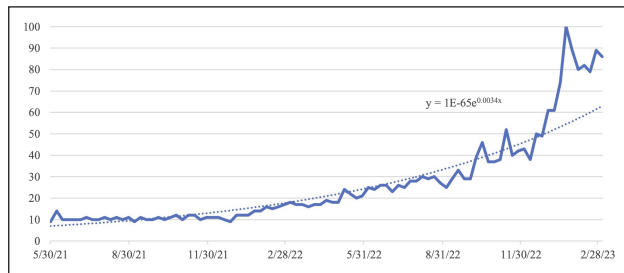


Figure 3. Relative search volume of the term “Ozempic”—June 2021 to February 2023.

Data Analysis

Filters were utilized to collect data from the United States between March 11, 2018 and February 26, 2023. The Google Trends data output recorded weekly RSVs, reflecting the relative search popularity of “Ozempic” as a search query each week. This was further compared to the terms “Wegovy” and “Mounjaro.” Simple linear regression models were used to assess the change of the search terms’ RSVs over time. Two-tailed unpaired Welch’s *t* tests were performed between successive monthly time points to determine significant changes in average RSV compared to the prior month. One-way analysis of variance was utilized to assess monthly RSV differences between “Ozempic,” “Wegovy,” and “Mounjaro.” Statistical analyses were completed in SPSS version 28 (IBM, Armonk, NY) with a defined α of 0.05.

RESULTS

Search Term: “Ozempic”

Our findings demonstrate a marked interest in “Ozempic” over the 5-year time period in the United States. Overall, the RSV in “Ozempic” grew exponentially, at a rate of $y = (2 \times 10^{-36})e^{0.0019x}$. At the start of the 5-year period, the RSV remained steady from March 2018 until a small peak in June 2021, plateauing again until December 2021. Subsequently, the RSV increased, at first slowly until October 2022, then significantly from December 2022 on. The entire 5-year RSV trend is depicted in Figure 1. The top 5 states associated with the greatest RSVs for “Ozempic” were Mississippi, West Virginia, Louisiana, Alabama, and Oklahoma (Figure 2).

After Wegovy, the “sister” semaglutide, gained FDA approval for weight-loss management in June 2021, the RSV for “Ozempic” grew even more exponentially, at a rate of $y = (5 \times 10^{-85})e^{0.0044x}$ (Figure 3). Between June and December 2021, no significant difference was found in the RSV. As such, the baseline time point was set at December 2021. A significant increase was

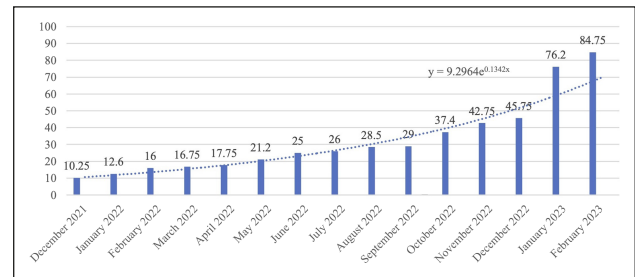


Figure 4. Average relative search volume of “Ozempic” by month—December 2021 to February 2023.

found in each following month’s average RSV compared to the baseline time point with an exponential growth rate of $y = 9.2964e^{0.1342x}$. With conversion of RSV data points to the natural log of the datapoint, linear regression analysis showed a significantly increased RSV over time with an R^2 of 0.915 and a regression coefficient of 0.957 ($P < .001$) (Supplemental Figure 1, available online at www.aestheticsurgeryjournal.com). Significant increases were also seen comparing successive months’ average RSV to the previous month ($P < .05$). Stratification of the average RSVs by months following December 2021 are depicted in Figure 4 and further detailed in Table 1.

Search Terms: “Ozempic,” “Wegovy,” and “Mounjaro”

When comparing “Ozempic” and “Wegovy” and “Mounjaro” between June 2021 (FDA approval of Wegovy) and February 2023, Ozempic remained at the greatest RSV throughout the period except in June 2021, as shown in Figure 5. One-way analysis of variance found statistically significant differences between the 3 search terms at all time points between December 2021 and February 2023 ($P < .001$).

“Wegovy” showed significant increases in a month’s average RSV compared with the previous month’s average RSV from January to April 2022, August 2022, October to November 2022, and again in January and February 2023 ($P < .05$). Linear regression analysis of the natural log conversions of “Wegovy” RSV datapoints showed an increased RSV over time with an R^2 of 0.540 and a regression coefficient of 0.735 ($P < .001$) (Supplemental Figure 2, available online at www.aestheticsurgeryjournal.com). “Mounjaro” showed similar significant increases compared with previous months from April to October 2022 ($P < .05$). Linear regression analysis of the natural log conversions of “Mounjaro” showed an increased RSV over time with an R^2 of 0.713 and a regression coefficient of 0.844 ($P < .001$) (Supplemental Figure 3, available online at www.aestheticsurgeryjournal.com). Since Mounjaro’s FDA approval in May 2022, the average monthly RSVs of

Table 1. Average Relative Search Value by Month of “Ozempic”

Time point	RSV of “Ozempic”	Comparison to previous month <i>P</i> -value
December 2021	10.3 [1.0]	—
January 2022	12.6 [0.9]	.008 ^a
February 2022	16.0 [0.8]	<.001 ^a
March 2022	16.8 [1.0]	.279
April 2022	17.8 [1.0]	.190
May 2022	21.2 [2.6]	.038 ^a
June 2022	25.0 [1.4]	.029 ^a
July 2022	26.0 [2.1]	.427
August 2022	28.5 [1.7]	.093
September 2022	29.0 [3.3]	.799
October 2022	37.4 [5.7]	.030 ^a
November 2022	42.8 [5.6]	.210
December 2022	45.8 [4.4]	.441
January 2023	76.2 [18.5]	.019 ^a
February 2023	84.8 [8.2]	.392

Values represent mean [standard deviation] unless otherwise noted. RSV, relative search volume. ^a*P*-values less than 0.05 were defined as statistically significant.

“Wegovy” and “Mounjaro” were significantly different in all months (*P* < .05) except July 2022 and February 2023, as detailed in Table 2.

DISCUSSION

These study data confirm a significant increase in public interest in the search term “Ozempic” as well as related GLP-1 agonists over the last 5 years in the United States. Ozempic and other GLP-1 agonists are relatively new medications to enter the healthcare industry. FDA approval was first given to exenatide (Bydureon; AstraZeneca, Cambridge, UK) for T2DM in April 2005,²¹ and has since been followed by the approval of a number of other GLP-1 agonists. In 2014, liraglutide (Saxenda; Novo Nordisk) was the first GLP-1 agonist to gain FDA approval for weight-loss management in nondiabetic obese patients.²² In December 2017, Ozempic (semaglutide 0.25, 0.5, 1.0, or 2.0 mg once weekly dosage) was approved for the treatment of T2DM.²³ In June 2021, Wegovy (semaglutide 2.4 mg once weekly dosage) was approved for weight-loss management in patients with obesity (BMI 30 kg/m² or greater)

Table 2. Average Relative Search Value by Month of “Wegovy” and “Mounjaro”

Time point	RSV of “Wegovy”	RSV of “Mounjaro”	<i>P</i> -value
May 2022	8.8 [0.8]	0.6 [0.5]	<.001 ^a
June 2022	9.0 [0.8]	4.3 [1.9]	.010 ^a
July 2022	8.4 [0.5]	9.4 [2.6]	.445
August 2022	7.3 [0.5]	13.0 [1.4]	.002 ^a
September 2022	8.3 [1.9]	22.3 [8.1]	.038 ^a
October 2022	13.0 [3.1]	31.6 [4.0]	<.001 ^a
November 2022	12.0 [2.0]	33.8 [4.6]	<.001 ^a
December 2022	13.8 [1.7]	32.3 [3.3]	<.001 ^a
January 2023	29.2 [3.8]	35.2 [4.0]	.041 ^a
February 2023	34.3 [1.3]	32.5 [1.0]	.073

Values represent mean [standard deviation] unless otherwise noted. RSV, relative search volume. ^a*P*-values less than 0.05 were defined as statistically significant.

or those who are overweight (27-30 kg/m²) in the presence of at least 1 weight-related comorbidity (ie, hypertension, dyslipidemia, T2DM).²⁴ Most recently, Mounjaro, a combination GLP-1 agonist and GIP (glucose-dependent insulinotropic polypeptide), was approved for T2DM treatment in May 2022.²⁵

Wegovy is the only semaglutide FDA-approved specifically for weight-loss management, yet Ozempic has garnered more public interest throughout its short history. Since Wegovy hit the public market in June 2021, its manufacturers Novo Nordisk have faced difficulty meeting the growing demand for the product. In December 2021, Novo Nordisk announced a shortage of Wegovy due to issues with good manufacturing practices.²⁶ During this time, our Google Trends analysis displayed the beginnings of peaked interest in Ozempic, which may be related to the start of its off-label usage for weight management.

Several studies²⁻¹² have demonstrated the large influence of celebrities, social media, and news publications in the current aesthetic trends and treatments. Celebrities Kim Kardashian and Mindy Kaling are few of many rumored to have used GLP-1 agonist medications for cosmetic weight losses. Sources have even alleged Hollywood groups hosting “Ozempic parties” for off-label administrations. Elon Musk, CEO of SpaceX (Hawthorne, CA), Tesla (Austin, TX), and Twitter (San Francisco, CA), tweeted, “Fasting + Ozempic/Wegovy + no tasty food near me.”²⁷ The time of these events corresponds with the significant uptick in RSV for “Ozempic” after December 2022. The attention surrounding Ozempic even extended to the 2023

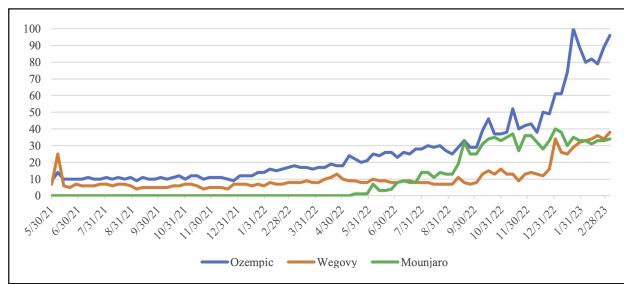


Figure 5. Relative search volume of “Ozempic” vs “Wegovy” vs “Mounjaro”—June 2021 to February 2023.

Academy Awards, during which host Jimmy Kimmel joked, “Everybody looks so great. When I look around this room, I can’t help but wonder, ‘Is Ozempic right for me?’”²⁸ Social media users share similar curiosity of #Ozempic with an impressive 690 million views on TikTok (ByteDance Ltd., Beijing, China) and over 50,000 posts on Instagram (Meta, Menlo Park, CA), many of which feature users’ positive weight-loss experiences on Ozempic.^{29,30}

The results of the current study underscore the impact of these sources on public opinion surrounding medical information over actual scientific publications and evidence. In particular, Mounjaro was shown to be significantly more effective at all doses (5, 10, and 15 mg) for blood sugar control and weight loss than semaglutide (1 mg). In fact, participants in the SURPASS-2 study lost up to an average 11.2 kg while taking Mounjaro, compared with 5.7 kg on semaglutide. Even at Mounjaro’s lowest dose, it was superior to semaglutide for weight loss.³¹ However, public interest as measured by Google Trends does not reflect Mounjaro’s pre-eminence, but instead appears more in line with social media and/or celebrity endorsements of Ozempic, further highlighting their impact on the public. An additional Google Trends search was conducted for the search term “Ozempic weight loss” to support that the search term “Ozempic” encompassed beyond those interested with T2DM and incorporated those interested in weight loss from the drug, and similar rising interest was found.³²

Unsurprisingly, 4 out of the 5 states found to have the highest RSV in “Ozempic” count among the top 5 states with the highest obesity prevalence according to the Centers for Disease Control and Prevention.³³ Interestingly, public interest in surgical treatments for obesity has by comparison remained stable over time,³⁴ indicating that perhaps medical weight loss may have become an enticing alternative.

In the first 9 months of 2022, Novo Nordisk’s sales in North America increased by 37% in Danish kroner (22% at constant exchange rates).³⁵ While providers turned to writing off-label prescriptions for Ozempic to meet their patients’ rising needs, the increased demand led to shortages

of this formulation, and in turn, significantly impacted patients dependent on Ozempic for management of their T2DM. At a monthly retail cost of around US\$1200,³⁶ use of Ozempic without insurance coverage is prohibitive for many patients. Mounjaro is even more costly, at over US \$1500 for a month’s supply.³⁷ App-based pharmacies, such as Capsule (New, York, NY), circumvented this issue by enabling consumers to obtain GLP-1 agonists for a fraction of this price, thus supporting further off-label use and causing many formulations of GLP-1 agonists to be on back-order, including Ozempic and Mounjaro. In response, insurers began requiring FDA-approved ICD-10 diagnosis codes for T2DM to be submitted with prescriptions for GLP-1 agonists in September 2022.^{38,39}

To address these off-label trends, Novo Nordisk explicitly states on its website: “Although Wegovy and Ozempic both contain semaglutide, they are different products with different indications, dosages, prescribing information, titration schedules, etc. The products are not interchangeable.”⁴⁰ Despite this, Wegovy and Ozempic have remained on the FDA’s list of medications in shortage.⁴¹ Given persistent demand, high out-of-pocket costs, and shortages of brand name GLP-1 agonists, many patients and providers have resorted to compounding pharmacies to obtain these medications.^{42,43} Compounded medications are usually considered safe and are strictly regulated. However, Novo Nordisk holds a patent on semaglutide, controlling all manufacturing of the ingredients. Critics consequently caution that the compounded semaglutide and related GLP-1 medications are being made from unclear sources and with different ingredient formulations (ie, semaglutide sodium).⁴⁴ To that end, Novo Nordisk warned in a public statement:

“We are aware that there are companies claiming to have availability of Wegovy or semaglutide. We want consumers and healthcare providers to know and be very clear that Novo Nordisk does not sell Wegovy (or its active ingredient, semaglutide) for the purposes of compounding with other products. We have not conducted studies to evaluate the safety and efficacy of Wegovy when compounded with other ingredients. Novo Nordisk is the only company that has FDA approval to market Wegovy and we supply it in a disposable single-use pen available by prescription only.”⁴⁰

Another circumvention to obtain GLP-1 agonist medications for weight loss has been through the utilization of app-based telemedicine, largely utilizing social media outlets, such as Instagram, as marketing platforms.^{45,46} Unfortunately, this can lead to insufficient health assessments, follow-ups, and patient management. Aware of these practices and potential liability implications, Novo

Nordisk has publicly distanced itself from this movement, stating: “We acknowledge the growing trend of weight-management telehealth providers, many of whom are advertising Wegovy. Novo Nordisk is not directly supplying Wegovy to any Telehealth providers.”⁴⁰

Although GLP-1 agonists are well tolerated by patients with T2DM²¹⁻²⁵ and have demonstrated cardioprotective and hepatoprotective properties in patients with cardiac-related morbidities,^{47,48} GLP-1 agonists are not without side effects, including gastrointestinal upset, pancreatitis, gallstones, hypoglycemia, kidney failure, allergic reactions, vision changes, tachycardia, depression, and suicidal ideation most prominent among them.^{21-25,49-51} Importantly, there is a paucity of data on their use for cosmetic weight loss in obese, nondiabetic patients, and even more so in nonobese, nondiabetic patients.

As public interest around this class of medications continues to soar, specifically surrounding cosmetic weight loss, many patients are likely to turn to plastic surgeons for primary medication management as well as body contouring procedures for weight-loss-induced skin laxity. Increased awareness and understanding of these medications among plastic surgeons will be important in providing appropriate patient counseling and treatment plans, as well as establishing our specialty as knowledgeable leaders in comprehensive aesthetic treatment modalities with safe, regulated, and standardized protocols. This is especially pertinent as many plastic surgery aesthetic practices now include “medispas” or weight-loss centers not primarily run by plastic surgeons. Additionally, cognizance of the shifting dynamics guided by media, and specifically social media, influencers, and celebrities, is essential in predicting future trends. Beyond their currently largely nonstandardized or unregulated aesthetic uses, knowledge of these drugs is of particular relevance to all plastic surgeons as they may potentially be utilized to optimize patients’ weight, whereby improving their operative candidacy and decreasing risks of obesity-related postoperative complications in a variety of procedures in the aesthetic, reconstructive, and general plastic surgical realm. As the number of patients taking GLP-1 agonist medications increases, plastic surgeons must work in coordination with the anesthetic team to weigh the perioperative implications, including delayed gastric emptying (which may increase perioperative aspiration risk) and the potential effects on nutritional status (with subsequent effects on wound healing). Further research is needed and currently underway to investigate outcomes after cosmetic use of GLP-1 agonists and to provide operative guidelines.

Limitations

There are several limitations to this study. “Ozempic,” “Wegovy,” and “Mounjaro” were the only search terms

used to gauge the RSVs in this topic. “Semaglutide” produced insufficient results and “GLP-1 agonist” was too broad of a search term for comparison. The search queries were also limited to those within the United States and were only searched on 2 different occasions. We recognize these search terms do not provide a full reflection of the interest in these drugs off-label use for cosmetic weight loss. Rovetta discussed the dependence of Google Trends’ search output on the day of search, stating multiple data queries were necessary to eliminate standard errors.⁵² However, between our 2 search occasions, data outputs were consistent and unchanged. Furthermore, although Google Trends has been recognized as a growing research tool, Arora et al note properties that need to be clarified regarding search query collection, organization, and coding.⁵³ Additionally, raw search values are unavailable through Google Trends, which may cause altered context of the data.

CONCLUSIONS

This study demonstrates a significant and growing public interest in GLP-1 agonists, namely Ozempic. As the use of GLP-1 agonists for weight loss becomes more prevalent, plastic surgeons, particularly in the aesthetic setting, must be prepared for the downstream implications. Increased awareness, understanding, and further scientific studies led by plastic surgeons will help deliver the safest possible patient outcomes.

Supplemental Material

This article contains [supplemental material](#) located online at www.aestheticsurgeryjournal.com.

Disclosures

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REFERENCES

1. Reid AJ, Malone PSC. Plastic surgery in the press. *J Plast Reconstr Aesthet Surg*. 2008;61(8):866-869. doi: [10.1016/j.bjps.2008.06.012](#)
2. Alshaalan HS, AlTamimi LA, Alshayie RA, Alsuhaibani AH. The impact of social media accounts on periorbital cosmetic surgeries. *Saudi J Ophthalmol*. 2021;35(3):251-256. doi: [10.4103/SJOPT.SJOPT_14_21](#)

3. Arab K, Barasain O, Altaweel A, et al. Influence of social media on the decision to undergo a cosmetic procedure. *Plast Reconstr Surg Glob Open*. 2019;7(8):e2333. doi: [10.1097/GOX.0000000000002333](https://doi.org/10.1097/GOX.0000000000002333)
4. Naftali Y B, Duek OS, Rafaeli S, Ullmann Y. Plastic surgery faces the web: analysis of the popular social media for plastic surgeons. *Plast Reconstr Surg Glob Open*. 2018;6(12):e1958. doi: [10.1097/GOX.0000000000001958](https://doi.org/10.1097/GOX.0000000000001958)
5. Borba A, Rodrigues M. Fox eye effect using a transcutaneous mini-eyebrow tail lift. *Am J Cosmetic Surg*. 2022;39(3):172-181. <https://doi.org/10.1177/0748806821107010>
6. Dhanda AK, Leverant E, Leshchuk K, Paskhover B. A Google Trends analysis of facial plastic surgery interest during the COVID-19 pandemic. *Aesthetic Plast Surg*. 2020;44(4):1378-1380. doi: [10.1007/s00266-020-01903-y](https://doi.org/10.1007/s00266-020-01903-y)
7. Di Gesto C, Nerini A, Policardo GR, Matera C. Predictors of acceptance of cosmetic surgery: Instagram images-based activities, appearance comparison and body dissatisfaction among women. *Aesthetic Plast Surg*. 2022;46(1):502-512. doi: [10.1007/s00266-021-02546-3](https://doi.org/10.1007/s00266-021-02546-3)
8. Eggerstedt M, Rhee J, Urban MJ, Mangahas A, Smith RM, Revenaugh PC. Beauty is in the eye of the follower: facial aesthetics in the age of social media. *Am J Otolaryngol*. 2020;41(6):102643. doi: [10.1016/j.amjoto.2020.102643](https://doi.org/10.1016/j.amjoto.2020.102643)
9. Obeid FM, Mortada H, Alsulaiman M, Faisal AISwaji G. The use of social media and its influence on undergoing rhinoplasty. *Plast Reconstr Surg Glob Open*. 2022;10(6):e4375. doi: [10.1097/GOX.0000000000004375](https://doi.org/10.1097/GOX.0000000000004375)
10. Pearlman RL, Wilkerson AH, Cobb EK, et al. Factors associated with likelihood to undergo cosmetic surgical procedures among young adults in the United States: a narrative review. *Clin Cosmet Investig Dermatol*. 2022;15:859-877. doi: [10.2147/CCID.S358573](https://doi.org/10.2147/CCID.S358573)
11. Tijerina JD, Morrison SD, Nolan IT, Parham MJ, Richardson MT, Nazerali R. Celebrity influence affecting public interest in plastic surgery procedures: google trends analysis. *Aesthetic Plast Surg*. 2019;43(6):1669-1680. doi: [10.1007/s00266-019-01466-7](https://doi.org/10.1007/s00266-019-01466-7)
12. Trinh LN, Safeek R, Herrera D, Gupta A. Has the COVID-19 pandemic impacted interest in cosmetic facial plastic surgery? A Google Trends analysis. *Facial Plast Surg*. 2022;38(3):285-292. doi: [10.1055/s-0041-1740623](https://doi.org/10.1055/s-0041-1740623)
13. Synnott A. Those weight loss drugs may do a number on your face. *New York Times*. Published January 24, 2023. Accessed March 11, 2023. <https://www.nytimes.com/2023/01/24/style/ozempic-weight-loss-drugs-aging.html>
14. Vogel K, Chesak J. 'Ozempic face': what is it and what can you do about it? Healthline. Published January 27, 2023. Accessed March 11, 2023. <https://www.healthline.com/health-news/ozempic-face-what-is-it-and-what-can-you-do-about-it>
15. Mavragani A, Ochoa G. Google Trends in infodemiology and infoveillance: methodology framework. *JMIR Public Health Surveill*. 2019;5(2):e13439. doi: [10.2196/13439](https://doi.org/10.2196/13439)
16. Nuti SV, Wayda B, Ranasinghe I, et al. The use of Google Trends in health care research: a systematic review. *PLoS One*. 2014;9(10):e109583. doi: [10.1371/journal.pone.0109583](https://doi.org/10.1371/journal.pone.0109583)
17. Google. Google Trends: understanding the data. Accessed March 11, 2023. <https://newsinitiative.withgoogle.com/resources/lessons/google-trends-understanding-the-data/>
18. Bellaire CP, Rutland JW, Sayegh F, Pesce RR, Tijerina JD, Taub PJ. Going viral: a systematic review of Google Trends in plastic surgery and a recommended framework for its use. *Aesthet Surg J*. 2021;41(12):NP2034-NP2043. doi: [10.1093/asj/sjab084](https://doi.org/10.1093/asj/sjab084)
19. Google Trends. Ozempic. Accessed March 7, 2023. <https://trends.google.com/trends/explore?date=today%205-y&geo=US&q=ozempic>
20. Google Trends. Ozempic versus Wegovy versus Mounjaro. Accessed March 11, 2023. <https://trends.google.com/trends/explore?date=today%205-y&geo=US&q=ozempic,mounjaro,wegovy&hl=en>
21. DeFronzo RA, Ratner RE, Han J, et al. Effects of exenatide (exendin-4) on glycemic control and weight over 30 weeks in metformin-treated patients with type 2 diabetes. *Diabetes Care*. 2005;28(5):1092-1100. doi: [10.2337/diacare.28.5.1092](https://doi.org/10.2337/diacare.28.5.1092)
22. Pi-Sunyer X, Astrup A, Fujioka K, et al. A randomized, controlled trial of 3.0 mg of liraglutide in weight management. *N Engl J Med*. 2015;373(1):11-22. doi: [10.1056/NEJMoA1411892](https://doi.org/10.1056/NEJMoA1411892)
23. Sorli C, Harashima SI, Tsoukas GM, et al. Efficacy and safety of once-weekly semaglutide monotherapy versus placebo in patients with type 2 diabetes (SUSTAIN 1): a double-blind, randomised, placebo-controlled, parallel-group, multinational, multicentre phase 3a trial. *Lancet Diabetes Endocrinol*. 2017;5(4):251-260. doi: [10.1016/S2213-8587\(17\)30013-X](https://doi.org/10.1016/S2213-8587(17)30013-X)
24. Wilding JPH, Batterham RL, Calanna S, et al. Once-weekly semaglutide in adults with overweight or obesity. *N Engl J Med*. 2021;384(11):989-1002. doi: [10.1056/NEJMoA2032183](https://doi.org/10.1056/NEJMoA2032183)
25. Rosenstock J, Wysham C, Frías JP, et al. Efficacy and safety of a novel dual GIP and GLP-1 receptor agonist tirzepatide in patients with type 2 diabetes (SURPASS-1): a double-blind, randomised, phase 3 trial. *Lancet*. 2021;398(10295):143-155. doi: [10.1016/S0140-6736\(21\)01324-6](https://doi.org/10.1016/S0140-6736(21)01324-6)
26. Novo Nordisk. Novo Nordisk announces supply challenges for Wegovy® in the US. Published December 17, 2021. Accessed March 11, 2023. <https://www.novonordisk.com/content/nncorp/global/en/news-and-media/news-and-ir-materials/news-details.html?id=92023>
27. @ElonMusk. Fasting + Ozempic/Wegovy + no tasty food near me. Accessed November 16, 2022. <https://twitter.com/elonmusk/status/1592768518050574336>
28. Academy of Motion Picture Arts and Sciences. 95th Academy Awards. American Broadcasting Company; 2023.
29. TikTok. #Ozempic. Accessed March 20, 2023. <https://www.tiktok.com/tag/ozempic?lang=en>
30. Instagram. #Ozempic. Accessed March 20, 2023. <https://www.instagram.com/explore/tags/ozempic/>
31. Frías JP, Davies MJ, Rosenstock J, et al. Tirzepatide versus semaglutide once weekly in patients with type 2 diabetes.

- N Engl J Med.* 2021;385(6):503-515. doi: [10.1056/NEJMoa2107519](https://doi.org/10.1056/NEJMoa2107519)
32. Google Trends. Ozempic weight loss. Accessed June 1, 2023. <https://trends.google.com/trends/explore?date=today%205-y&geo=US&q=ozempic%20weight%20loss&hl=en>
 33. Centers for Disease Control and Prevention. Adult obesity prevalence maps. Updated September 27, 2022. Accessed March 11, 2023. <https://www.cdc.gov/obesity/data/prevalence-maps.html>
 34. Google Trends. Gastric bypass surgery. Accessed March 15, 2023. <https://trends.google.com/trends/explore?geo=US&q=%2Fm%2F03bxyx&hl=en>
 35. Novo Nordisk. Company announcement: financial report for the period 1 January 2022 to 30 September 2022. Published November 2, 2022. Accessed March 11, 2023. <https://www.novonordisk.com/news-and-media/news-and-ir-materials/news-details.html?id=143008>
 36. SingleCare. Ozempic coupons & prices. Accessed March 20, 2023. <https://www.singlecare.com/prescription/ozempic-2-mg-dose>
 37. SingleCare. Mounjaro coupons & prices. Accessed March 20, 2023. <https://www.singlecare.com/prescription/mounjaro>
 38. Medical Mutual. Drug policy. Accessed March 20, 2023. <https://www.medmutual.com/-/media/MedMutual/Files/Providers/Prior-Auth-Rx/GLP1-Agonist.pdf>
 39. UnitedHealthcare. Prior Authorization/Medical Necessity—GLP-1 & Dual GIP/GLP-1 Receptor Agonists. Accessed March 20, 2023. <https://www.uhcprovider.com/content/dam/provider/docs/public/resources/pharmacy/oxford/Diabetes-Medications-GLP-1-Receptor-Agonists-Oxford.pdf>
 40. Novo Nordisk. Updates about Wegovy. Accessed March 11, 2023. <https://www.novonordisk-us.com/products/product-supply-update.html>
 41. US Food and Drug Administration. FDA Drug Shortages. Accessed March 20, 2023. <https://www.accessdata.fda.gov/scripts/drugshortages/default.cfm>
 42. Landsverk G. Shortages of a ‘game changer’ weight-loss drug are driving people to buy potentially risky knockoff versions. *Insider*. Published February 2, 2023. Accessed March 11, 2023. <https://www.insider.com/buy-compounded-semaglutide-online-risks-wegovy-ozempic-2023-1>
 43. Lovelace B, Lewis R, Kopf M. The high price of Ozempic is pushing many to unregulated, copycat drugs for weight loss. *NBC News*. Published March 19, 2023. Accessed March 20, 2023. <https://www.nbcnews.com/health/health-news/ozempic-wegovy-semaglutide-compounding-weight-loss-safe-rcna72990>
 44. Alliance for Pharmacy Compounding. Tempted to compound semaglutide sodium? Don’t. Published November 4, 2022. Accessed March 11, 2023. <https://web.archive.org/web/20221105070430/https://a4pc.org/2022-11/tempted-to-compound-semaglutide-sodium-dont/>
 45. Nguyen J, Enoch J, Pawlowski A. To get off-label Ozempic prescriptions, some people turn to telehealth websites. *Today*. Published February 1, 2023. Accessed March 20, 2023. <https://www.today.com/health/diet-fitness/ozempic-online-prescriptions-weight-loss-rcna68445>
 46. Gagne Y. Ads for weight-loss drug Ozempic are now blanketing New York City subways. *Fast Company*. Published March 18, 2023. Accessed March 20, 2023. <https://www.fastcompany.com/90867950/ads-for-weight-loss-drug-ozempic-are-now-blanketing-new-york-city-subways>
 47. Del Olmo-Garcia MI, Merino-Torres JF. GLP-1 receptor agonists and cardiovascular disease in patients with type 2 diabetes. *J Diabetes Res.* 2018;2018:4020492. doi: [10.1155/2018/4020492](https://doi.org/10.1155/2018/4020492)
 48. Marx N, Husain M, Lehrke M, Verma S, Sattar N. GLP-1 receptor agonists for the reduction of atherosclerotic cardiovascular risk in patients with type 2 diabetes. *Circulation.* 2022;146(24):1882-1894. doi: [10.1161/CIRCULATIONAHA.122.059595](https://doi.org/10.1161/CIRCULATIONAHA.122.059595)
 49. Filippatos TD, Panagiotopoulou TV, Elisaf MS. Adverse effects of GLP-1 receptor agonists. *Rev Diabet Stud.* 2014;11(3-4):202-230. doi: [10.1900/RDS.2014.11.202](https://doi.org/10.1900/RDS.2014.11.202)
 50. Novo Nordisk. Common side effects of Wegovy. Accessed March 11, 2023. <https://www.wegovy.com/taking-wegovy/side-effects.html>
 51. Novo Nordisk. Common side effects. Accessed March 11, 2023. <https://www.ozempic.com/how-to-take/side-effects.html>
 52. Rovetta A. Reliability of Google Trends: analysis of the limits and potential of web infoveillance during COVID-19 pandemic and for future research. *Front Res Metr Anal.* 2021;6:670226. doi: [10.3389/frma.2021.670226](https://doi.org/10.3389/frma.2021.670226)
 53. Arora VS, McKee M, Stuckler D. Google Trends: opportunities and limitations in health and health policy research. *Health Policy.* 2019;123(3):338-341. doi: [10.1016/j.healthpol.2019.01.001](https://doi.org/10.1016/j.healthpol.2019.01.001)