Research Square

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Hyping Bariatric Surgery Research in the Glucagon-Like Peptide-1 Era

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Abstract

Background:

Promotional language (“hype”) in scientific writing may exaggerate findings and influence interpretation. In obesity research, especially bariatric surgery, concerns exist that evolving therapies such as GLP-1 agents may affect how results are framed.

Objectives:

To assess temporal trends in promotional language in bariatric surgery research and compare them with other obesity-related and general medical literature.

Setting:

Bibliometric analysis of original research articles from 13 high-impact peer-reviewed journals in obesity medicine, bariatric surgery, nutrition, and general medicine.

Methods:

We analyzed 40,914 original research articles published between 2010 and 2025. Studies were classified as obesity-related or non-obesity-related and further stratified by topic, including bariatric surgery, GLP-1 therapies, diet, exercise, and preclinical research. Promotional language was measured using a validated list of 139 hype adjectives. Outcomes included prevalence of hype (≥ 1 adjective per abstract) and mean frequency per abstract. Temporal trends were assessed using Mann–Kendall tests, and regression models evaluated associations with study characteristics.

Results:

Hype was more common in obesity-related than non-obesity studies (90.0% vs 82.6%, $p < 0.01$). Non-obesity studies showed declining hype over time ($\tau = -0.82$), whereas obesity-related studies remained high or increased ($\tau = 0.13$ for prevalence; $\tau = 0.52$ for frequency, $p < 0.01$), with a rise after 2023. Bariatric surgery studies had the highest hype prevalence (93.4%) and greater frequency than other obesity domains.

Conclusions:

Promotional language is highly prevalent and increasing in bariatric surgery research compared with other fields, highlighting the need for clearer and more balanced scientific communication.

Introduction

Clear and responsible scientific communication is essential to maintaining the credibility of bariatric surgery research. As the field evolves alongside rapidly advancing pharmacologic therapies for obesity, the presentation and interpretation of surgical outcomes are increasingly scrutinized. A central challenge of scientific writing is balancing accurate reporting of results with appropriate interpretation of their significance[1]. Under increasing pressure to publish and secure funding, bariatric surgeon-researchers may adopt promotional language that exaggerates the importance of their findings, a practice known as "hype.[2]" Hype (promotional language) has been defined as the use of promotional, hyperbolic, and dramatic language to glamorize, embellish, or exaggerate aspects of scientific research[3]. Although such promotional language may appear benign, premature or exaggerated claims can mislead readers and, over time, erode public trust in science[4].

These considerations are particularly relevant in the current therapeutic landscape shaped by glucagon-like peptide-1 (GLP-1) receptor agonists[5,6]. The rapid uptake of these agents has expanded non-surgical treatment options and intensified comparisons between medical and surgical approaches. Bariatric surgery research is now frequently evaluated alongside medical therapies with differing mechanisms, risks, and durability. In this context, there may be increased incentive to emphasize the effectiveness or distinct advantages of surgical interventions, potentially influencing how findings are framed.

Despite substantial advances in safety and effectiveness, bariatric surgery research has historically faced challenges to its scientific legitimacy due to perceived bias in scientific messaging[7], pervasive weight bias[8], and a legacy of ineffective, and often harmful, obesity treatments[9]. Scientific communication plays a central role in how these developments are conveyed and understood. Overly promotional framing may complicate interpretation, particularly when incremental findings are presented as more definitive than supported by the data. The objective of this study was to evaluate temporal trends in promotional language in bariatric surgery research and to compare these patterns with general medical literature over time, as well as across obesity treatment domains.

Materials and Methods

Study Selection and Data Extraction

This bibliometric study included original research articles published between January 1, 2010, and December 31, 2025, in 13 peer-reviewed journals. The journals were selected based on impact factor, representing highest impact publications in disciplines including obesity medicine, bariatric surgery, nutrition, and general medicine. The selected journals were categorized as obesity journals (*Obesity*, *International Journal of Obesity*, *Obesity Science & Practice*, *Clinical Obesity*, *Diabetes, Obesity & Metabolism*), bariatric surgery journals (*Obesity Surgery*, *Surgery for Obesity and Related Diseases*), nutrition journals (*American Journal of Clinical Nutrition*, *Nutrition Journal*), and general medicine journals

(*The Lancet*, *The New England Journal of Medicine (NEJM)*, *Journal of the American Medical Association (JAMA)*, and *British Medical Journal* (*BMJ)*).

All articles were identified through PubMed (https://pubmed.ncbi.nlm.nih.gov/) using the *rentrez* package in R, which systematically retrieved journal name, publication year, title and abstract text. Decision was made to analyze titles and abstracts only, rather than the full text, because titles and abstracts are the most consistently available and standardized sections across journals, allowing for reproducible, large-scale comparison of language without bias from heterogeneous full-text formats and access limitations. Moreover, they represent the primary narrative framing visible to the readers, making them the most relevant segments for assessing hype language prevalence. Reviews, editorials, and articles without publicly available abstracts were excluded. Institutional review board approval was not required for this bibliometric analysis of publicly available data.

Artificial intelligence (AI) tools were for brainstorming keywords used for identifying study topics, as described below, but not used for the collection, processing, analysis, or interpretation of any data reported in this manuscript. During manuscript writing, AI was used for grammar, spelling, and clarity editing, without altering the scientific content, results, or conclusions.

Study Categorization and Promotional Language Identification

We developed a keyword-based classification scheme to identify study topics through an iterative process that combined ChatGPT-assisted term generation with manual review and refinement by the study team (Table 1). The final list of keywords was first applied to titles and abstracts to categorize studies as obesity-related or non–obesity-related. Subsequently, we categorized each obesity study based on its topic domain into bariatric surgery, glucagon-like peptide-1 (GLP-1) therapies, non–GLP-1 anti-obesity medications, diet, exercise, and preclinical research. A study may have been marked as containing more than one topic at the same time.

Table 1
Keywords for Promotional Language and Study Topic

Section	Category / Indicator Variable	Keywords / Terms Used
Hype Adjectives	Importance	compelling, critical, crucial, essential, foundational, fundamental, imperative, important, indispensable, invaluable, key, major, paramount, pivotal, significant, strategic, timely, ultimate, urgent, vital
	Novelty	creative, emerging, first, groundbreaking, innovative, latest, novel, revolutionary, unique, unparalleled, unprecedented
	Rigor	accurate, advanced, careful, cohesive, detailed, nuanced, powerful, quality, reproducible, rigorous, robust, scientific, sophisticated, strong, systematic
	Scale	ample, biggest, broad, comprehensive, considerable, deeper, diverse, enormous, expansive, extensive, fastest, greatest, huge, immediate, immense, interdisciplinary, international, interprofessional, largest, massive, multidisciplinary, myriad, overwhelming, substantial, top, transdisciplinary, tremendous, vast
	Utility	accessible, actionable, deployable, durable, easy, effective, efficacious, efficient, generalizable, ideal, impactful, intuitive, meaningful, productive, ready, relevant, rich, safer, scalable, seamless, sustainable, synergistic, tailored, tangible, transformative, user-friendly
	Quality	ambitious, collegial, dedicated, exceptional, experienced, intellectual, longstanding, motivated, premier, prestigious, promising, qualified, renowned, senior, skilled, stellar, successful, talented, vibrant
	Attitude	attractive, confident, exciting, incredible, interesting, intriguing, notable, outstanding, remarkable, surprising
	Problem	alarming, daunting, desperate, devastating, dire, dismal, elusive, stark, unanswered, unmet
Study Topic Keywords	Obesity-Related	obesity, overweight, adiposity, body mass index, BMI, fat, weight loss, gastric bypass, sleeve gastrectomy, metabolic syndrome, weight gain, bariatric
	GLP1 Therapy	glucagon-like peptide-1, glp-1, glp1 receptor agonist, glp1-ra, glp-1 analog, glp-1 mimetic, incretin, gut hormone therapy, semaglutide, liraglutide, dulaglutide, exenatide, lixisenatide, albiglutide, tirzepatide, efpeglenatide, Wegovy, Ozempic, Saxenda, Victoza, Trulicity, Byetta, Bydureon, Mounjaro, Zepbound, danuglipron, LY3305677, ITCA 650
	Non-GLP1 Anti-obesity Medication	orlistat, alli, xenical, phentermine, phentermine-topiramate, qsymia, bupropion-naltrexone, contrave, lorcaserin, rimonabant, appetite suppressant, centrally acting anorectic, lipase inhibitor, fat absorption inhibitor, gastrointestinal lipase inhibitor, antiobesity agent, setmelanotide, tesofensine, cetilistat, small molecule anti-obesity agent
	Bariatric Surgery	bariatric surgery, metabolic surgery, weight-loss surgery, obesity surgery, surgical obesity treatment, surgical weight loss, gastric bypass, Roux-en-Y gastric bypass, RYGB, sleeve gastrectomy,

Section	Category / Indicator Variable	Keywords / Terms Used
		laparoscopic sleeve gastrectomy, adjustable gastric band, lap band, gastric banding, duodenal switch, biliopancreatic diversion, BPD, mini-gastric bypass, LAP-BAND, Realize Band, intragastric balloon, Orbera balloon, laparoscopic bariatric surgery, minimally invasive metabolic surgery, open gastric bypass, robot-assisted bariatric surgery, LSG, AGB
	Diet	dietary intervention, diet intervention, weight-loss diet, calorie restriction, caloric restriction, energy restriction, dietary modification, nutrition intervention, nutritional therapy, low-calorie diet, low-fat diet, low-carbohydrate diet, low-carb diet, ketogenic diet, keto diet, Mediterranean diet, high-protein diet, high-fiber diet, intermittent fasting, very-low-calorie diet, VLCD, meal replacement, portion control, balanced diet, diet counseling, dietitian-led program, nutrition counseling, hypocaloric, energy-restricted, calorically restricted, dietary regimen, nutrition plan, food-based intervention
	Exercise	exercise intervention, physical activity intervention, exercise program, training program, structured exercise, physical activity program, exercise therapy, exercise regimen, physical activity therapy, lifestyle intervention, aerobic exercise, endurance training, resistance training, strength training, strength and conditioning, weight training, circuit training, high-intensity interval training, HIIT, moderate-intensity continuous training, MICT, flexibility training, balance training, treadmill exercise, cycling, stationary cycling, swimming, aquatic exercise, walking, brisk walking, jogging, running, rowing, pilates, yoga, calisthenics, supervised exercise, home-based exercise program, exercise counseling, exercise prescription, behavioral exercise intervention, physical activity promotion, exercise-based lifestyle intervention, energy expenditure intervention, exercise-induced, cardiorespiratory fitness program, exercise training program
	Preclinical	preclinical, basic science, mechanistic study, experimental study, laboratory study, bench research, translational research, in vivo study, in vitro study, ex vivo study, mouse model, mice, rat model, rats, murine model, rodent model, animal model, swine model, pig model, non-human primate, monkey model, zebrafish model, canine model, feline model, cell culture, primary cells, cell line, hepatocyte, adipocyte, myocyte, pancreatic islet, organoid, tissue explant, knockout mouse, transgenic mouse, CRISPR, molecular mechanism, in vitro assay, in vivo assay, experimental intervention, mechanistic pathway, signaling pathway, molecular pathway, gene expression, protein expression, histology, immunohistochemistry, flow cytometry, preclinical evaluation, animal study, experimental model, rodent study, cellular model, molecular study, mechanistic evaluation

Promotional language was identified using a previously validated list of 139 “hype” adjectives developed by Millar *et al.*, derived from keyword analysis of over 900,000 National Institutes of Health abstracts[3]. These hype adjectives were grouped into eight semantic domains: importance, novelty, rigor, scale, utility, quality, attitude, and problem.

The complete list of keywords used for study classification and hype adjective identification is provided in Table 1.

Statistical Analysis

Promotional language use was operationalized via the number of hype adjectives identified in the study abstract. The *prevalence* of hype adjective use was defined as the proportion of studies containing any hype adjective, while hype adjective *frequency* was defined as the average number of hype adjectives per study abstract.

Descriptive statistics were used to summarize study characteristics across obesity-related and non-obesity-related articles. Group differences in proportions were assessed using two-sample t-tests. Temporal trends in the prevalence of hype adjective use and in mean hype adjective frequency per study were evaluated using the Mann–Kendall trend test, with Kendall's tau used to describe the direction and strength of monotonic trends over time. To account for differences in journal impact, a sensitivity analysis was conducted restricting the sample to select high-impact, prominent general medicine journals (*JAMA*, *NEJM*, *The Lancet*, and *BMJ*), and all comparative and trend analyses were repeated within this subgroup.

Among obesity-related studies, hype adjective use was further examined by journal type and study topic. Linear regression models were constructed to evaluate factors associated with hype adjective frequency, with hype adjective frequency as the outcome variable and study topic (bariatric surgery, GLP-1 therapy, non–GLP-1 anti-obesity medication, diet, exercise, and preclinical research) and journal type (bariatric surgery journal, obesity medicine journal, nutrition journal, general medicine journal) as predictor variables. General medicine journals served as the reference category. Regression coefficients are reported with 95% confidence intervals.

All statistical tests were two-sided, and a p-value < 0.05 was considered statistically significant. All analyses were performed using RStudio version 2024.09.1 + 394 (R Foundation for Statistical Computing, Vienna, Austria).

Results

Obesity and Non-Obesity Studies

A total of 85 329 articles were identified from 13 journals published between 2010 and 2025. After excluding reviews, editorials, and articles without an abstract indexed in PubMed, 40 914 articles were included in the final analysis. Of these, 23 095 (56.4%) were classified as obesity-related.

Obesity-related studies were significantly more likely to use hype adjectives than non-obesity studies (20 789/23 095 (90.0%) vs 14 716/17 819 (82.6%), $p < 0.01$). Over time, the prevalence of hype adjective use declined among non-obesity studies ($\tau = -0.82$, $p < 0.01$), whereas hype adjective use remained

consistently high among obesity-related studies ($\tau = 0.13$, $p = 0.49$; Fig. 1a). Similarly, the mean number of hype adjectives per study decreased among non-obesity studies ($\tau = -0.58$, $p < 0.01$) but increased among obesity-related studies ($\tau = 0.52$, $p < 0.01$), particularly since the year 2023 (Fig. 1b).

Because of substantial differences in journal impact factor between obesity-focused journals and general medicine journals, a sensitivity analysis was conducted restricting the sample to high-impact general medicine journals (JAMA, *NEJM*, *The Lancet*, and *BMJ*). This included 12 594 studies, among which 1 753 (13.9%) were obesity-related. Within this subgroup, hype adjectives remained more prevalent in obesity-related studies than in non-obesity studies (1 548/1 753 (88.3%) vs 2 525/10 069 (82.6%), $p < 0.01$). Over time, hype adjective use declined among non-obesity studies ($\tau = -0.52$, $p < 0.01$), reaching 59.6% (692/1 161) by 2025. In contrast, obesity-related studies continued to exhibit both a higher prevalence and greater frequency of hype adjective use.

Promotional Language in Bariatric Surgery Studies

We first examined the distribution of study topics within the obesity-related literature. Bariatric surgery represented the largest proportion of publications (8,647 studies), exceeding preclinical research (3,415), diet (1,984), exercise (1,747), GLP-1–based therapies (1,565), and non–GLP-1 pharmacotherapy (713). Across all obesity-related topics, the prevalence of hype adjective use was high and relatively uniform, ranging from 87.2% in preclinical studies to 93.4% in bariatric surgery studies (Fig. 2), with bariatric surgery demonstrating the highest overall prevalence.

When stratified by journal type, bariatric surgery journals exhibited the highest prevalence of promotional language (93.9%), followed by nutrition journals (90.4%), general medicine journals (88.3%), and obesity medicine journals (87.1%). Across most journal categories, the mean number of hype adjectives per study increased over time, with the exception of general medicine journals, where levels remained more stable or declined.

In adjusted linear regression models restricted to obesity-related studies, bariatric surgery–related publications contained a significantly higher frequency of hype adjectives compared with non–bariatric surgery studies. On average, bariatric surgery studies used 0.35 more hype adjectives per abstract (95% CI 0.20–0.50; $p < 0.01$). Similarly, studies involving non–GLP-1 anti-obesity medications, diet, and exercise contained 0.54 (95% CI 0.28–0.81; $p < 0.01$), 0.16 (95% CI 0.02–0.31; $p < 0.01$), and 0.26 (95% CI 0.10–0.41; $p < 0.01$) more hype adjectives, respectively. In contrast, preclinical studies used fewer hype adjectives on average (− 0.28; 95% CI − 0.40 to − 0.17; $p < 0.01$). Among all clinical domains examined, bariatric surgery consistently remained among the highest in frequency of promotional language use.

Discussion

In this study, we found that not only do obesity-related studies use more promotional language than non–obesity-related studies, bariatric surgery studies appeared to have the highest frequency and intensity of promotional language use. Unlike other medical fields, where promotional language has

declined over time, its use in obesity research has increased steadily, particularly in clinical studies about bariatric surgery, with a pronounced rise since the year 2023.

The structural incentives in academia that promote exaggerated research conclusions have been well known for decades. “In one study, 21% of university press releases were found to contain exaggerations and caveats[10]. In another, more than half of randomized controlled trials with non-significant or negative results were deemed to have distorted the interpretation of their results[11]. This is probably because the use of promotional language is associated with greater public attention[12] and higher funding success[13]. One study reported that grant applications using promotional language were twice as likely to be funded[14]. Against this backdrop, increasing use of promotional language in the scientific literature is perhaps unsurprising. For example, Havorson et al. found that the proportion of orthopedic abstracts containing hype adjectives rose from 67.0% in 1985 to 92.5% in 2020[15]. These findings align with our results, which showed that 90.0% of obesity-related studies published between 2010 and 2025 contained at least one hype adjective.

Self-promotion is especially worrisome in bariatric surgery research because, historically, bariatric surgery research has been marginalized by medical academia due to weight stigma[8], prejudice of obesity as a lifestyle failure rather than a biological condition[16], and the lack of effective treatments for a long time[17]. Furthermore, obesity research is disproportionately influenced by commercial interests in food, beverage[18], pharmaceutical[19], and surgical industries[19]. To assess whether promotional language use differ between obesity research from other medical fields, we restricted the sample to four high-impact general medical journals, consisting largely of non–obesity-related studies. Notably, promotional language use in these journals declined over the study period, likely reflecting deliberate editorial efforts to limit hype in high-quality medical literature[20]. In contrast, promotional language in obesity-related articles remained prevalent, even in high-impact journals, with a recent sharp rise since 2023.

While identifying the cause of this increase is beyond the scope of our study, its timing coincides with the public enthusiasm surrounding GLP-1 receptor agonists around late 2022[21]. Our topic-level analyses revealed that promotional language was most heavily used in bariatric surgery studies, rather than GLP-1–related studies. On the other hand, preclinical studies were least likely to be hyped. One possible explanation is that, amid a perceived paradigm shift driven by GLP-1 therapies, bariatric surgery researchers may feel compelled to employ promotional language to emphasize the continued relevance of surgery[22].

Despite our focus on examining promotional language, this study, while novel in topic, rigorous in execution, and comprehensive in scope, still has several limitations. First, our list of keywords may not accurately capture exaggeration in scientific writing. Hype is often contextual and relational, arising from syntax, semantics, and discourse structure rather than from isolated adjectives. On the other hand, some words classified as hype (e.g., “significant,” “systematic,” or “successful”) may be entirely appropriate in

context. Second, our reliance on PubMed data may have led to misclassification of article types or omission of original research lacking publicly available abstracts[23]. Finally, increased promotional language in bariatric surgery research may not be uniformly detrimental. Used appropriately, promotional language can reflect intrinsic innovativeness and help communicate scientific merit by engaging readers cognitively. In this sense, promotional language may serve as a tool for signaling novelty and importance rather than merely inappropriately exaggerating results.

In conclusion, we found that, in contrast to many other medical fields, obesity research exhibits both higher levels and a recent acceleration of promotional language use, particularly since 2023, with this trend being especially pronounced in bariatric surgery. While this trend may increase visibility and attention in the short term, its long-term implications for scientific credibility and public trust in bariatric surgery remain uncertain and warrant further study. A clear next step for the field is to prioritize precise and balanced scientific communication by actively minimizing promotional language in bariatric surgery research, thereby enhancing credibility, reducing misinterpretation, and fostering greater trust among clinicians, patients, and the public.

Declarations

Conflict of Interest Statement:

The authors have no conflict of interest to disclose.

Author Contribution

MC, FF and YJ conceived and designed the study. MC and YJ contributed to data acquisition, data curation, and analysis. MC and YJ interpreted the findings and drafted the manuscript. FF, VH, and RS critically revised the manuscript for important intellectual content. All authors reviewed and approved the final manuscript and agree to be accountable for the work.

Data Availability

The research data is publicly available on Pubmed.

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Figures

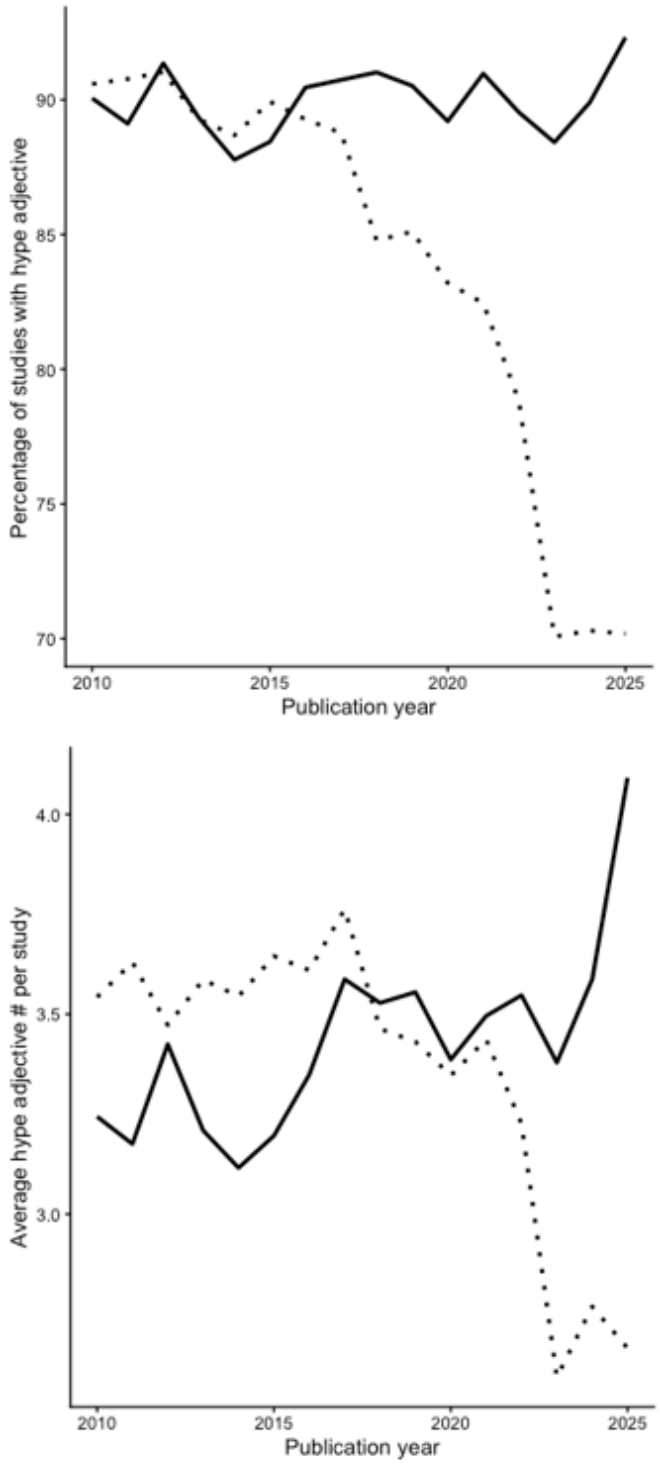


Figure 1

Temporal trend of hype adjective use

Legend: 1a) While the percentage of studies with hype adjective s decreasing among non-obesity studies (dotted line), the use of hype adjectives remains persistently prevalent among obesity studies (solid

line). 1b) the average number of hype adjective per study has decreased in non-obesity studies (dotted line), but increased in obesity studies (solid line).

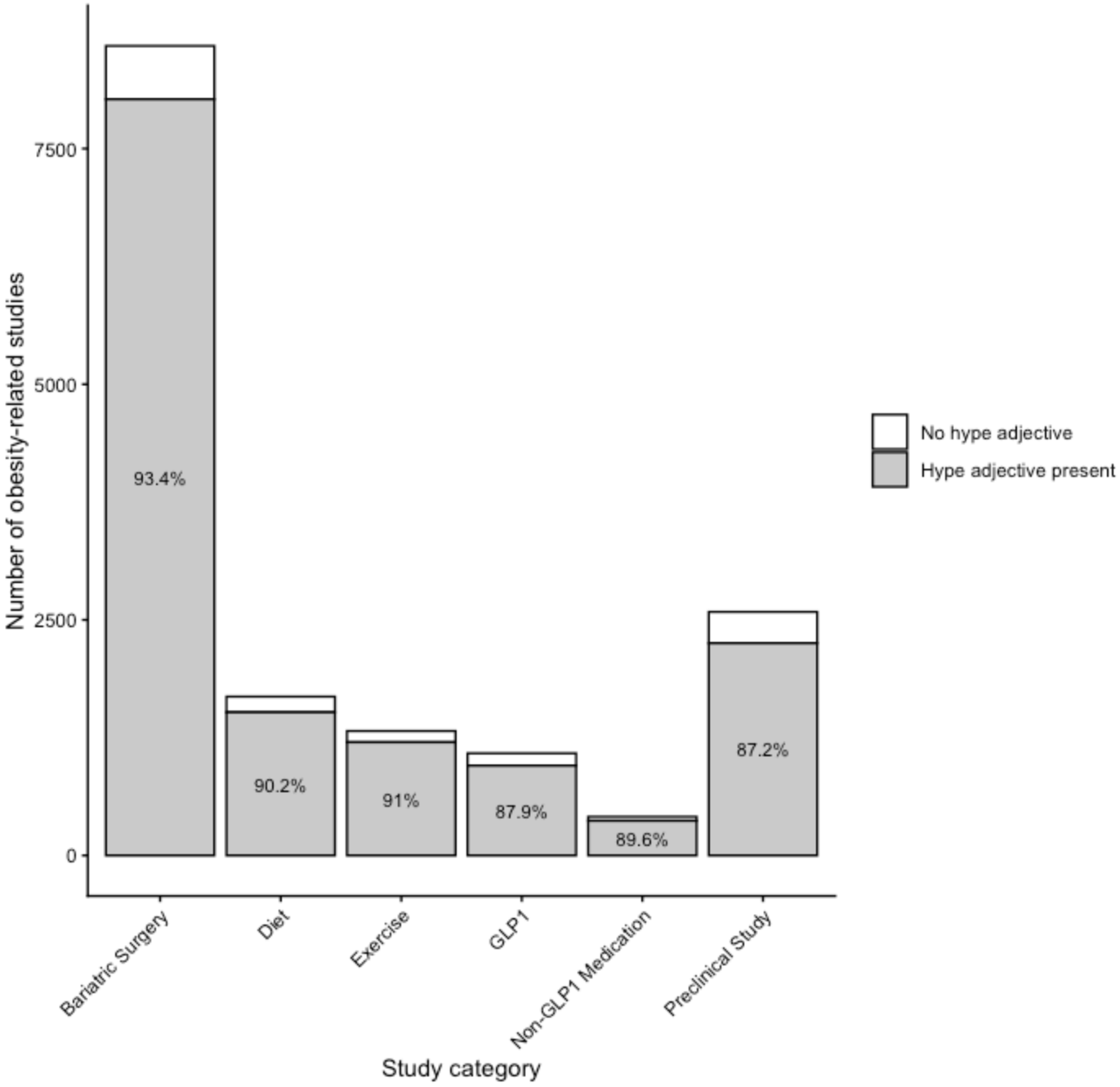


Figure 2

Stacked bar charts demonstrating study number and hype adjective use

Legend: There were more obesity studies related to bariatric surgery than any other subject matter. Hype adjective ranged between 87.9% and 93.4% for obesity studies of various subject matters, compared with 82.6% for non-obesity studies.