

The Impact of Self-Monitoring Behaviors and Connectivity to a Bariatric Clinic via a Mobile Application on Long-Term Weight Loss Outcomes after Sleeve Gastrectomy

Story C, Abeling D, Dowlati Y, Datta A.

March 2024

Outline

- I. Summary
 - a. Key findings
 - b. Proposed recommendations
- II. Problem statements
- III. Introduction
- IV. Existing literature
- V. Methodology
- VI. Results
- VII. Discussion
- VIII. Strengths, limitations & future directions
- IX. Conclusion
- X. Clinical applications and user experience of Baritastic
 - a. HCP user experience
 - b. Patient user experience
- XI. Baritastic capabilities
- XII. References

Summary:

This paper explores the impact of self-monitoring behaviors using the mobile application Baritastic on weight loss outcomes following laparoscopic sleeve gastrectomy (LSG).

Our research highlights the significance of regular self-monitoring behaviors, facilitated by a digital health platform, in enhancing long-term weight loss results. This data also uncovers the positive role of a strong clinic-patient connection in supporting patient adherence to postoperative recommendations.

Key findings include a correlation between:

1. Increased frequency of dietary self-monitoring with improved weight loss outcomes.
2. Increased frequency of self-weighing with improved weight loss outcomes.
3. Increased frequency of dietary self-monitoring when patients are connected to their bariatric clinic via Baritastic.

These findings underscore the importance of self-monitoring and highlight the opportunity to incorporate technology into postoperative care plans. Strengthening the connection between patients and clinics can enhance patient outcomes.

From these insights, we propose several recommendations:

1. Promote regular, consistent, and long-term self-monitoring of body weight and food intake after LSG using Baritastic.
2. Strengthen clinic-patient connections by incorporating Baritastic into pre- and postoperative care pathways.

3. Encourage Baritastic app usage by connecting clinic's educational content, support group calendars, automated messages, and weigh-in reminders to assist in patient care.

Our research and recommendations aim to optimize long-term weight loss outcomes in post-LSG patients, emphasizing the crucial role of self-monitoring behaviors and professional support via technology in patient care.

Additionally, using a mobile application designed for bariatric patients, which offers customization from their designated bariatric center, may improve the quality of healthcare education delivered to post-bariatric surgery patients, contributing to their successful recovery and overall wellbeing.

Problem statements:

- Obesity remains a significant public health concern, with the prevalence increasing from 30.5% to 42.4% in the United States between 2000 and 2018.¹
- Bariatric surgery remains the most effective intervention for severe obesity, with LSG currently being the most common procedure, although successful long-term weight management post-surgery remains a challenge.
- Weight recurrence (WR) and insufficient weight loss (IWL) are common, depending on the definitions used for both, and can lead to the recurrence of weight-related co-morbidities or the need for a revisional procedure, placing the patient at greater risk for medical complications.¹

There is an urgent need for effective strategies and tools that enhance long-term patient engagement to protect the patient from WR. The implications of this issue go beyond the individual patient's health, impacting the healthcare system by increasing costs and resource utilization when IWL or WR occurs after metabolic and bariatric surgery (MBS), particularly in the case of LSG.

Furthermore, patient experiences of WR following bariatric surgery indicate that it is often a challenging and unexpected circumstance. When WR occurs, patients express emotions of hopelessness, discouragement, shame, and frustration.² Implementing social support, self-care practices, and behavioral strategies may enhance the long-term management of weight post-surgery.

The role of dietary and body weight self-monitoring via a mobile application connected to the patient's bariatric clinic following surgery has become an area of interest. This practice empowers patients to actively participate in their health management, opening avenues for improved post-surgical outcomes. A digital platform, specifically a mobile application, can streamline this process by tracking weight and food intake, potentially enhancing weight loss results, and instilling confidence in health outcomes for patients and practitioners alike.

Mobile apps have the potential to significantly improve the perioperative care of bariatric surgery patients. They can help enforce perioperative protocols and contribute to better surgical outcomes. By promoting patient adherence to these protocols and facilitating early identification of postoperative complications or challenges, mobile technology has shown its potential to enhance patient care. Notably, studies have demonstrated that mobile apps can effectively improve patient adherence to prescribed perioperative protocols and enhance clinical attendance.³

Considering the widespread use of smartphones, mobile apps are rapidly gaining popularity as a more accessible substitute or adjunct to conventional patient education methods, such as offering a paper binder of educational materials.

Introduction:

Bariatric surgery is currently the most effective treatment for obesity, recognized as a chronic, relapsing, and progressive disease.⁴ LSG is the most performed operation, within the bariatric community, representing approximately 61% of procedures in the US.⁵

Research studies have demonstrated that up to 30% of patients who undergo LSG experience IWL or WR and may require a revisional procedure.⁶ The International Federation of Obesity and Metabolic Disorders considers the procedure successful if the percentage of excess weight loss (%EWL) remains steady and surpasses 50% during the long-term follow-up period.

However, a significant fraction of patients (15–20%) fail to achieve this benchmark. Post-LSG %EWL values in numerous studies typically range from 45 to 65% at the 24-month timepoint. The failure to achieve desired weight loss outcomes post-surgery is likely due to multiple factors. Numerous variables have been suggested to predict weight loss following LSG, including preoperative weight, dietary habits, surgical methods, underlying health conditions, gender, and smoking habits.⁷

Self-monitoring behaviors, such as tracking body weight and maintaining food logs, have been widely recognized as key strategies for weight loss and weight management.⁸ Research suggests that self-monitoring activities provide individuals with a sense of control over their dietary habits and body weight, which assists with promoting weight loss and weight maintenance.⁹ Additionally, studies suggest that participants who use digital platforms in their weight loss interventions report ease of use and have high retention and engagement rates.¹⁰

One study highlighted an 89% satisfaction rate among users who used a mobile application for weight loss, noting their willingness to recommend the tool to others – which can assist in patient-to-patient support and encouragement.¹⁰

Particularly in MBS, consistent self-monitoring can significantly enhance the procedure's effectiveness and increase the likelihood of long-term weight loss success.¹¹ Integrating of mobile applications into this process can significantly support self-monitoring efforts by providing accessibility, ease of use, and real-time feedback.¹²

Existing literature provides compelling evidence on the effectiveness of self-monitoring behaviors in improving weight loss outcomes and managing weight post-bariatric surgery, particularly in the case of LSG.¹¹

Lynch and colleagues evaluated the impact of dietary and weight monitoring behaviors on weight loss after bariatric surgery and discovered a significant, positive correlation between dietary monitoring and weight outcomes. Their findings indicated that dietary monitoring behaviors, such as keeping food records and weighing and measuring food, at 12 months were positively correlated with total weight loss and percent excess weight loss. However, no significant association was found between the frequency of body weight self-monitoring and weight loss outcomes during this intermediate postoperative timeframe.

This underscores the significant influence of the surgical procedure itself on weight-related outcomes within the initial 12 months postoperative. Research shows the most significant decrease in body weight occurs in the first year, followed by a gradual increase over the ensuing decade for many patients, representing the longest-term data available.¹³

Gaps persist in the current literature on the effectiveness of self-monitoring behaviors in the long-term postoperative period. Additionally, many studies primarily focus on the role of self-monitoring in weight loss with limited emphasis on the role of connectivity to healthcare providers via mobile applications. Research is scarce on whether the utilization of these technologies correlates with long-term weight management post-surgery.

Research demonstrates that embracing behavioral changes, such as regular exercise and following bariatric dietary recommendations, leads to better long-term weight-loss results.¹⁴ Therefore, it is crucial to prioritize patient education, engagement, and adherence to clinical protocols as integral aspects of care for bariatric patients.

A plethora of data exists in non-surgical weight loss interventions, suggesting that the more frequent touchpoints between a patient and provider result in more effective body weight loss compared to one-time interventions.¹⁵ While not extensively explored in bariatric research, it stands to reason that more frequent appointments with a clinician would lead to better weight loss outcomes for the patient.

Although bariatric healthcare practitioners (HCPs) likely recognize the significance and necessity of postoperative education and counseling, one obstacle that prevents them from offering these services is the associated cost to the patient.¹⁶ However, patients often request more comprehensive behavioral programs to manage their long-term health. Surveys indicate that over 80% of post-bariatric surgery patients want a program to prevent or reverse WR, and 71% of patients express a desire for more internet-based support at home.¹⁷

Unfortunately, this is not feasible for most bariatric centers or HCPs due to scheduling restraints and large patient caseloads. Adopting the use of a connected mobile application within the clinic can help alleviate some of the call burden to the clinic, improve the opportunity for provider-to-patient communication via automated push notifications, and reduce the number of triage calls or emails to the provider by housing all education material in one place, at a patient's fingertips.

Effective perioperative patient education and engagement play a vital role in caring for individuals undergoing bariatric surgery. These aspects hold significant importance given the limited length of stay and the necessity to adhere to multiple instructions. Heuser et al. analyzed the effects of utilizing a mobile application on post-surgery complications during the 30-day recovery period at home. They documented the positive impact of a mobile application in reducing postoperative complications during the 30-day home recovery period. When they survived their patients one-month post-discharge, they found that app usage significantly reduced the need for phone calls to the office and visits to the emergency department. Additionally, 94.8% of patients reported that they would recommend the app to other patients.³

Increasing the utilization of Baritastic can enhance patient learning and outcomes. This platform provides post-surgical recommendations for success, including a collection of over 100 high-protein recipes crafted by bariatric registered dietitians. Additionally, it offers features like hydration and vitamin reminders, as well as tracking medical appointments. For comprehensive support, patients can also access bariatric clinic information and real-time program education materials.

This study aims to examine the significance of its connectivity feature between the patient and clinic and assess the impact of dietary and body weight self-monitoring via the Baritastic mobile application on post-surgery weight loss outcomes.

Existing literature: Impact of Self-monitoring on Weight Loss after Bariatric Surgery

24-month prospective cohort study

115 post-LSG; 269 post-RYGB
Huang et al. SOARD. 2021.

Using mobile software, patients were instructed to:

- Upload food journal daily (dietary self-monitoring)
- Body weight 1 x month (body weight self-monitoring)

Patient collection groups:

- Group 1 those who self-monitored at every time point (n=166 (LSG n=77; RYGB n=89))
- Group 2 those who stopped self-monitoring at 6 months postoperative (n=218 (LSG n=38; RYGB n=180))

Results: Percentage excess weight loss (%EWL)

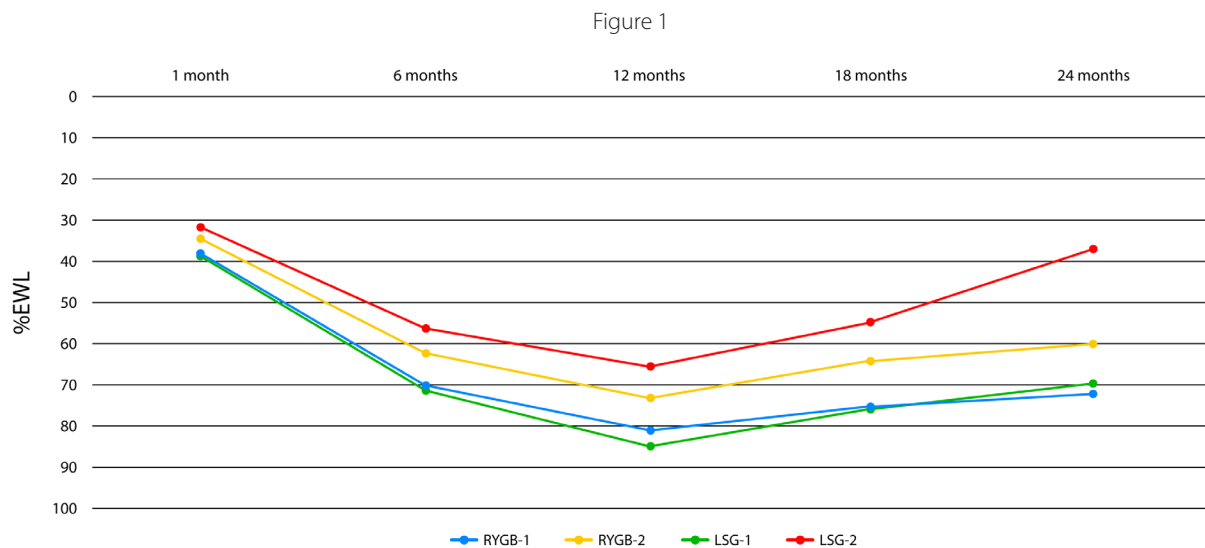


Figure 2

Postop Timepoint	RYGB Group 1	RYGB Group 2	LSG Group 1	LSG Group 2
1 month	38	34	39*	31
6 months	70*	62	71*	56
12 months	81*	73	85*	64
18 months	75*	64	75*	55
24 months	72*	60	70*	37

*Statistical significance

Study highlights:

- This study found that the long-term self-monitoring behavior group had superior weight loss outcome post-bariatric surgery compared to the short-term self-monitoring behavior group. (LSG n=38; RYGB n=180)
- The study findings indicate that consistent self-monitoring is crucial for achieving improved weight loss results, especially with LSG.
- It is important to note that there was no intervention from the clinic during this study; the onus was on the patient to self-monitor and adjust behaviors accordingly.

Methods:

A national retrospective study was conducted on patients using the Baritastic mobile application who underwent LSG between November 2017 and January 2022. Eligibility for participation required patients to have maintained food logs for at least 10 days per month over a minimum of 1 year following their surgery date, along with logging their weight at least once for each 3-month period after surgery using the Baritastic mobile application. The app account was created between 01/01/2017 and 12/31/2021 by the patients and offered free of charge. Patients became aware of this application either through their clinic or independently. They utilized the app to actively track their dietary intake and body weight. Patients may have also used other standard Baritastic app features including reminders, exercise tracking, photo timelines, accessing 'bariatric-friendly' recipes, gratitude journaling, bite timers, and vitamin tracking. Patients connected to their clinic on Baritastic may have had access to educational content, support group calendars, videos, and other content that the clinic made available. Exclusion criteria included the improper identification of age, gender, and height.

In this research, excess body weight was defined as having a body mass index (BMI) of 25 kg/m² or above. The study used Percent Excess Weight Loss (%EWL) as the primary indicator for assessing weight loss outcomes. To compute %EWL, the excess weight was initially calculated with the formula: current weight (lbs) - ideal body weight (IBW) (lbs). IBW was defined as a BMI of 25 kg/m², using Hamwi computations. Subsequently, %EWL was determined using the formula: (total weight loss (lbs)/excess weight (lbs)) x 100).

The study examined several hypotheses: (1) More frequent weigh-ins will be associated with greater excess weight loss; (2) Regular logging of food intake will correlate with greater excess weight loss; (3) Consistent app usage will contribute to improved excess weight loss outcomes; (4) A clinic connection will boost the frequency of weight log updates; and (5) Clinic engagement will elevate the number of food log entries on the app.

Statistical Analysis:

Statistical analysis was conducted on two specific time intervals: within 30 days of 18 months post-operation and within 30 days of 24 months post-operation, using an alpha level of 0.05 to determine significance. Statistical significance was set at a p-value of less than 0.05. This threshold indicates that if the p-value is below 5%, the correlation is considered statistically significant, leading us to reject the null hypothesis of no correlation.

The methodology involved identifying the weight log entry closest to the 18-month and 24-month post-operation milestones. If the nearest weight log to the 18-month mark fell within a 30-day window, that individual's data were included in the 18-month analysis set. Similarly, inclusion in the 24-month analysis set required a weight log entry within 30 days of the 24-month post-operation date. It is important to note that some participants were eligible for inclusion at one time point but not the other, while others qualified for both.

Statistical analysis was performed in Python using Jupyter Notebook. Given the data's characteristics and the aim of the analysis, the Spearman and Pearson correlation methods were used to deduce the results.

Results:

A total of 4728 patients were included in this study. The mean age of participants was 44 ± 10.66 . Of the patient population, 11.46% were identified as male. At the time of their sleeve gastrectomy, the patients' mean BMI was recorded at 45.74 ± 7.91 . Follow-up measurements indicated a mean BMI of 31.22 ± 6.39 at 18 months post-op, which marginally increased to a mean of 31.79 ± 6.59 at 24 months post-op.

There were 4728 entries in the original dataset, 2478 entries within 30 days of 18 months post-op, and 1826 entries within 30 days of 24 months post-op.

The frequency of weigh-ins significantly contributed to %EWL. Each weigh-in correlated with a 0.086 unit (95% CI: 0.047-0.126) increase in EWL within 30 days post-18 months surgery and a 0.055 unit (95% CI: 0.009-0.101) increase within 30 days post-24 months surgery ($p < 0.001$).

Similarly, tracking food intake through logs positively affected EWL. Each food log entry corresponded to a 0.178 unit (95% CI: 0.141-0.215) increase in %EWL within 30 days post-18 months surgery and a 0.152 unit (95% CI: 0.106-0.198) increase within 30 days post-24 months surgery ($p < 0.001$).

App usage also positively influenced EWL, indicating that each instance of app usage leads to a 0.212 increase (95% CI: 0.172-0.251) in the percentage of EWL within 30 days post-18 months surgery and a 0.173 increase (95% CI: 0.127-0.219) within 30 days post-24 months surgery ($p < 0.001$).

Conversely, being connected to a clinic negatively correlated with the frequency of weight logs recorded in the app. Being connected to a clinic resulted in a 0.045 decrease (95% CI: -0.085- -0.006) in weight logs within 30 days post-18 months surgery and a 0.12 decrease (95% CI: x-x) within 30 days post-24 months surgery ($p = 0.615$).

However, connection to a clinic positively correlated with the number of food logs entered in the app. Being connected to a clinic is associated with a 0.11 increase (95% CI: 0.072-0.151) in food logs within 30 days post-18 months surgery and a 0.085 increase (95% CI: 0.038-0.130) within 30 days post-24 months surgery ($p < 0.001$).

The analysis indicates that patients connected to a practice had an average excess weight loss of 72.45% at 18 months and 69.27% at 24 months post-sleeve gastrectomy. These figures illustrate a sustained trend of weight loss up to two years post-surgery, although there is a small decrease in excess weight loss as time elapses, which is the typical trend following LSG.

The data reveals a discernible trend in analyzing the impact of food log frequency on weight loss post-surgery. Those who ranked in the top 33% for food log entries achieved an average of 79.97 %EWL at 18 months and 76.20 %EWL at 24 months post-operation. These numbers underscore a clear association between the regular logging of food intake and a higher percentage of excess weight loss following surgery.

Discussion:

The present study found that the frequency of self-monitoring dietary intake and body weight via a mobile application positively impacted %EWL. Additionally, more frequent app usage showed a beneficial effect on %EWL. Conversely, being linked to a clinic negatively influenced how often patients self-monitored their body weight. Several factors could explain this observation.

First, patients connected to their clinic might solely rely on clinic visits for tracking their body weight, or they might be limited to using the clinic's sophisticated scales due to needing a reliable scale at home. Second, it's important to note that, during the study period, clinics could send automated reminders to patients who hadn't logged their food intake, supporting our conclusion that clinic connectivity increased the frequency of dietary self-monitoring. However, the app did not have automated reminders for body weight tracking at that time, potentially contributing to the decrease in body weight self-monitoring. Additionally, in previous studies on post-bariatric patients, barriers to checking body weight were identified via patient surveys and found that common themes were fear of the scale, using other methods like assessing the way clothing fit, or relying on clinic visits to check their body weight.¹⁹

Our study found that patients connected to a clinic had an average EWL of 72.45% at 18 months and 69.27% at 24 months post-LSG. This data aligns with Huang et al. who found that post-LSG patients who engaged in self-monitoring reached an EWL of 75.2% at 18 months and 70.14% at 24 months, compared to those who did not self-monitor with an EWL of 54.94% at 18 months and 36.95% at 24 months. This underscores the significant impact of self-monitoring behaviors on weight loss outcomes after sleeve gastrectomy.

Given our findings, it is imperative to understand the nuanced role that digital tools and clinic engagement play in a patient's weight loss journey post-LSG. The data underscores the significance of integrating technological solutions with traditional clinical support to optimize patient outcomes. Our research highlights the positive impact of mobile applications in reinforcing self-monitoring habits and also draws attention to the potential limitations of relying too heavily on clinic-based monitoring systems. This balance between digital and direct healthcare interventions is crucial for developing a comprehensive, patient-centered approach to weight management, especially for the post-LSG patient.

Vital et al. conducted a retrospective analysis of a cohort comprising 149 patients a decade post-LSG; postoperative data at 10 years was available for 118 patients. The study found that merely 19.5% of patients maintained satisfactory weight loss, as defined by ≥ 50 %EWL, without undergoing a revisional surgery ten years after LSG. The average %EWL at the 10-year mark was $36\% \pm 33$, compared to 68% at year one.¹⁸

Similarly, a recent multicenter retrospective study of patients who underwent an initial LSG from 2008 to 2017 found that only 20% of patients who maintained follow-up for a minimum of 5 years managed to sustain significant weight loss.¹³ Their cohort of 339 patients, with an average follow-up period of 7.1 years found that 15.9% of patients had IWL and 64% had significant WR.

Additionally, they found that patients who experienced a greater percent total body weight loss (%TBWL) in the first postoperative year were associated with higher weight loss outcomes at their last follow-up visit. This is important to note as self-monitoring studies in bariatric literature support the effectiveness of dietary and body weight self-monitoring in assisting in increased levels of weight loss during the first 12 months. The findings of these studies indicate the importance of early and close weight follow-up and management by the patient and care team.

Given the high frequency of initial LSG surgeries and the low rate of sustained weight loss over the long term, there is a pressing demand for effective interventions to address this issue. Improving weight loss outcomes after LSG is top of mind for the majority of clinicians and patients alike.

Among non-surgical populations, frequent self-monitoring of body weight is linked to increased weight loss and weight maintenance.¹⁹ Research suggests that individuals who track their weight tend to engage in more weight control measures like cutting down on snacks and desserts, walking more, and limiting TV time. Regular weight tracking can help individuals catch small weight gains early, making them easier to address compared to larger increases.

However, patients' reactions and responses to self-monitoring their body weight need to be honored, as previous studies indicate that some patients can become fearful of becoming obsessed with weight or seeing weight regain.¹⁹ Addressing these concerns involves collaboration between the patient and healthcare provider by breaking down fear-based barriers and educating the patient on the significance of self-monitoring body weight for long-term weight control.

High health literacy is among the various factors that influence successful weight loss following bariatric surgery.²⁰ Health literacy refers to the ability of individuals to access, comprehend, and apply basic health information and services, enabling them to make informed decisions about their wellbeing.²¹ Providing educational health information plays a crucial role in enhancing a patient's health literacy.

In a study examining patient perspectives on adherence to clinic protocols, participants emphasized the significance of patient education. They expressed the belief that enhancing and expanding educational efforts would benefit their care.²² Digital healthcare education can enhance interventions by leveraging technology to foster habit formation, which can be achieved through automated message prompts or electronic calendar reminders.

When developing new technologies and clinical pathways for supporting users like HCPs or patients, it's vital to consider their motivations. HCPs may be concerned about the perceived extra workload of counseling patients on dietary choices if they promote frequent utilization of self-monitoring methods like maintaining a food diary. This concern might lead HCPs to avoid suggesting self-monitoring techniques to reduce office call volume. However, studies indicate that the frequency of dietary monitoring is more crucial than the detail or comprehensiveness of the food log or the subsequent review with the HCP.²³ Also, research has demonstrated that utilizing a mobile app for managing post-surgery concerns decreased the necessity for office phone calls and visits to the ER.³

Furthermore, Huang et al. discovered that the clinician could remain "hands off" and allow the patient to change behavior when recording their food and body weight consistently. No intervention was required on the part of the clinician, leaving the onus to the patient and theoretically improving outcomes into the future as the patient learns to rely on their ability to assess food intake and make appropriate changes or reach out to the clinic when they experience undesirable WR.

The relationship between digital intervention tools and traditional clinic engagement is not merely supplementary but, symbiotic. The interaction between mobile app-based self-monitoring and regular clinic follow-ups presents a compelling narrative for optimizing long-term success in weight management post-LSG. By carefully navigating this intersection, we can improve patient care and education strategies that can significantly elevate the standards of patient care and ensure optimized weight loss outcomes.

Strengths, limitations & future directions:

One notable strength of this study was the extensive sample size (n=4728). The study clearly demonstrated that being linked to a bariatric clinic led to increased adoption of dietary self-monitoring habits. Both the frequency of dietary and body weight self-monitoring was associated with improved weight loss results. However, the study was limited by its observational design, which prevented an assessment of app usage characteristics like the effects of push notifications on health behaviors or the utilization of specific app features on long-term weight loss outcomes. During the study period, there were no weigh-in reminders through the app, and automatic reminders to log food intake were only triggered if the user ceased tracking their food intake. If patients were connected to their bariatric clinic, clinic protocols could have automatically sent messages, like push notifications, to record food intake if the patient had not engaged in these behaviors within a specific timeframe. Furthermore, the study did not consider variations in preoperative BMI, a crucial factor known to influence weight loss outcomes following LSG, nor did it account for pre or postoperative comorbidities, medication usage, ethnicity, or other demographic factors.

To enhance future research, a controlled study should be conducted to evaluate app usage. This study should define clear parameters, including adherence to app usage recommendations from the clinic and participant characteristics. Although the present study revealed statistical differences, indicating the benefits of using the Baritastic app to connect with the bariatric clinic and improve long-term weight loss post-LSG, the absence of a control group prevents establishing a direct link between app usage and weight loss outcomes.

It is plausible that patients who increase their app usage post-LSG might be those who are more focused on health behaviors, which may indicate that individuals with high self-motivation might engage with the app more frequently. Conversely, app usage could result in greater benefits and awareness of health enhancements, offering a positive experience that encourages continued interaction with the app. While not within the present study's scope, future research could explore the influence of clinic protocols on app usage and long-term outcomes.

Conclusion:

A significant number of LSG patients experience IWL or WR, which may contribute to the return of obesity-related health issues. While postoperative follow-up and behavioral interventions have been linked to improved weight loss outcomes, many patients do not attend or receive these services. Further strategies are required to effectively target and enhance the likelihood of sustained treatment for postoperative patients, including the potential for long-term use of a bariatric-specific mobile application to connect to their bariatric clinic. An advantage of using the Baritastic app is the ability for clinics to schedule automated reminders to help patients stay consistent with self-monitoring their dietary intake and body weight. Additionally, clinics can upload current educational materials and support group calendars to enhance ongoing learning long after the patient's procedure.

Clinical applications and user experience of Baritastic

HCP user experience

Bariatric practices around the US have been utilizing the Baritastic app in direct patient care since 2017, with adoption rates varying across the nation. Heavy users of the app share a unique perspective and can offer a lens into what clinical practice looks like when patients self-monitor their dietary intake and can receive their education directly on their phones.

L. Casey Flowers MS, RD, LDN, CDCES, has been using Baritastic in large-volume surgical practices for the last seven years. She points out a few key highlights regarding the enhanced clinical effectiveness she has experienced due to this technology.

From the clinician's perspective, Casey finds value in the application via several different avenues, stating:

"I can help them monitor their progress and be a source of additional accountability. I can see if they set reminders to take their vitamins and if they check those reminders off. We can also track their weight trends over time and assess what might be impacting their progress. It's so helpful from a clinical and potential research perspective.

It's a neat tool that can analyze macronutrient and micronutrient breakdowns, presenting detailed insights into the individual's dietary composition. It will even go as far as to break down their 'Top 10' calorie-dense food items, allowing us to discuss more nutrient-dense alternatives.

We give our patients hard copies of nutrition education, but those go missing a lot of times. I tell them the best part of using this app is when you get a new phone you can just download the app and all of our programs' nutrition education materials will be there waiting for you.

It helps me to not feel like a broken record. I pull up their food log before going into the exam room and then I get to focus on bigger problems. Instead of saying, "Let me show you how to read nutrition facts," it's "How can I help you work on your patterns?" That's what's been most helpful to me as a dietitian."

When healthcare providers can break free from repetitive nutrition education, they can dedicate more time to counseling and guiding patients toward behavioral changes. This allows them to tailor clinical appointments to address specific areas needing improvement. Linking educational program materials to a mobile app can eliminate the problem of misplaced resources, decrease phone inquiries to the clinic, and empower patients to engage more meaningfully in their healthcare journey.

Patient user experience

"As soon as the clinic recommended this app to teach food intake even six months prior to my scheduled surgery, I downloaded and started using it. Even though I've successfully lost weight four times previously (I'm horrible at keeping it off), I had never tracked my food intake and considered it a waste of time – that was until I started using this app. It has been so helpful and informative in helping me lose weight prior to surgery, and I'm convinced it will be a critical tool to use after surgery. I am able to view my caloric, water, and other macronutrient intake with informative graphs. I am easily able to enter information into the app and it does the rest. Remarkable! With this app, I can clearly see how many calories per day I'm taking in... I have compared this with other subscription apps, and this one is superior..."

"It's the best out there. Easy to understand and work with."

"It has wonderful tracking features and barcode scanners to make it easier to track food/snacks. The weight tracker is especially nice if you want to track your pre and post-surgical weights accurately."

"This app is so wonderful. I can track anything I drink or eat. This allows me to keep track of my calories, carbohydrates, protein intake, calorie counts, and much more. I love the meal planning, I can put something in that I would like, if its not a good choice at that time, it will let me know to choose a different meal. I love this app!!!"

~Real reviews from the Apple App Store

Baritastic capabilities

Patients love Baritastic, rating it 4.8 out of 5 stars with over 70k+ ratings.

Baritastic is a software platform for clinics and hospitals to better manage their patients, improve engagement, drive compliance, and get patients to surgery quicker. Patients use the popular mobile app to track nutrition, log exercise, set up reminders, review educational content, and access their calendar of support group meetings. Your clinic or hospital can monitor your patient's progress, review nutrition, set up and monitor pathways, create custom checklists, use our patient pipeline, send messages, and more.

Create customized checklists

Create custom insurance checklists with reminders for your patients to follow on their app. View and confirm their progress in the provider dashboard.

Patient Pipeline

Create custom patient pathways to track your patients' journey through surgery and beyond. Identify any pauses in their progress and evaluate potential barriers to their success throughout the program.

Patient Engagement

Set up automated messages triggered when patients take certain actions on the Baritastic app. For example, you can automatically send patients one message when they reach three months postop and send another if they don't log their meals for four days.

Nutrition review

Utilize the robust dashboard for dietitians to review food logs, activity, sleep, weight, vitamin compliance, and more.

References:

1. Majid SF et al. Current state of the definition and terminology related to weight recurrence after metabolic surgery: review by the POWER Task Force of the American Society for Metabolic and Bariatric Surgery. *Surg Obes Relat Dis.* 2022;18(7):957-963.
2. Tolvanen L et al. Patients' Experiences of Weight Regain After Bariatric Surgery. *Obes Surg.* 2022;32:1498-1507.
3. Heuser J et al. Impact of a Mobile App to Support Home Recovery of Patients Undergoing Bariatric Surgery. *J Surg Res.* 2021;261:179-184.
4. Kermansaravi M et al. Current recommendations for procedure selection in class I and II obesity developed by an expert modified Delphi consensus. *Sci Rep.* 2024;14(1):3445.
5. Clapp B et al. American Society for Metabolic and Bariatric Surgery 2020 estimate of metabolic and bariatric procedures performed in the United States. *Surg Obes Relat Dis.* 2022;18(9):1134-1140.
6. Saliba C et al. Weight Regain After Sleeve Gastrectomy: A Look at the Benefits of Re-sleeve. *Cureus.* 2018;10(10):e3450.
7. Doğan S et al. Residual Gastric Volume Relationship and Weight Loss After Laparoscopic Sleeve Gastrectomy. *Obes Surg.* 2020;30(5):1929-1934.
8. Burke L.E. et al. Self-monitoring in weight loss: a systematic review of the literature. *Journal of the American Dietetic Association.* 2011;111(1):92-102.
9. Hartmann-Boyce J et al. Experiences of Self-Monitoring in Self-Directed Weight Loss and Weight Loss Maintenance: Systematic Review of Qualitative Studies. *Qualitative Health Research.* 2019;29(1):124-134.
10. Patel Michele L et al. Detailed Versus Simplified Dietary Self-monitoring in a Digital Weight Loss Intervention Among Racial and Ethnic Minority Adults: Fully Remote, Randomized Pilot Study. *JMIR formative research.* 2022;6(12)e42191.
11. Huang X et al. Impact of Self-Monitoring on Weight Loss After Bariatric Surgery. *Obes Surgery.* 2021;31:4399-4404.
12. Flores Mateo G et al. Mobile phone apps to promote weight loss and increase physical activity: A systematic review and meta-analysis. *Journal of Medical Internet Research.* 2015;17(11):e253.
13. Lind R et al. Long-term outcomes of sleeve gastrectomy: weight recurrence and surgical non-responders. *Obesity Surgery.* 2023;33(1):3028-3034.
14. Toussi R et al. Pre- and Postsurgery Behavioral Compliance, Patient Health, and Postbariatric Surgical Weight Loss. *Obesity.* 2009;17:996-1002.
15. Tewskbury C, Isom K. Behavioral Interventions After Bariatric Surgery. *Curr Treat Options Gastro.* 2022;20:366-375.
16. Breuing J et al. Healthcare delivery and information provision in bariatric surgery in Germany: qualitative interviews with bariatric surgeons. *BMC Health Serv Res.* 2021;21:659.
17. Bradley LE et al. A Survey of Bariatric Surgery Patients' Interest in Postoperative Interventions. *Obes Surg.* 2016;26:332-338.
18. Vital R et al. Long-term outcomes 10 years after laparoscopic sleeve gastrectomy: a single center retrospective analysis. *Obes Surg.* 2023;33(8):2356-60.
19. Lynch S et al. To Keep Myself on Track: The Impact of Dietary and Weight Monitoring Behaviors on Weight Loss After Bariatric Surgery. *Journal of Behavioral Medicine.* 2018;41(5):574-583.
20. Erdogdu UE et al. Health Literacy and Weight Loss After Bariatric Surgery. *Obes Surg.* 2019;29:3948-3953.
21. Sorensen K et al. Consortium Health Literacy Project European. Health Literacy and Public Health: A Systematic Review and Integration of Definitions and Models. *BMC Public Health.* 2012;25(12):80.
22. Mahawar K et al. Patient Perspectives on Adherence with Micronutrient Supplementation After Bariatric Surgery. *Obes Surg.* 2019;29:1551-1556.
23. Peterson ND et al. Dietary self-monitoring and long-term success with weight management. *Obesity.* 2014;22: 1962-1967.