

Original article

Three-year weight outcomes from a bariatric surgery registry in a large integrated healthcare system

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Abstract

Background: A registry was created for patients having procedures for weight loss from 2004 to the present time at a large integrated healthcare system. The objective of this study was to compare findings to the literature and national quality monitoring databases and present 3-year weight loss outcomes.

Methods: Patients are passively enrolled in the registry with the following characteristics: a bariatric procedure for weight loss after January 1, 2004 and actively enrolled in the health plan at the time of surgery.

Results: Compared to national surgical quality databases, the registry (n = 20,296) has a similar proportion of Roux-en-Y gastric bypass (RYGB; 58%), more vertical sleeve gastrectomy (SG; 40%), fewer banding (2%) procedures, more Hispanic patients (35%), and higher rates of 1 year follow-up (78%). RYGB patients lost more weight at every time point up to 3 years after surgery compared with SG patients ($P < .001$). Non-Hispanic white RYGB patients had a higher percent excess weight loss than non-Hispanic black ($P < .001$) and Hispanic ($P < .001$) RYGB patients. There were no differences between SG racial/ethnic groups in percent excess weight loss throughout the 3-year follow-up period.

Conclusion: We are one of the first groups to publish comparison weight outcomes for RYGB and SG in a diverse patient population, showing that the responses to RYGB and not SG vary by race/ethnicity. (Surg Obes Relat Dis 2014;10:396–404.) © 2014 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords:

Racial and ethnic minorities; Successful weight loss; Surgical quality monitoring; Men and women

Over 15% of U.S. adults suffer from severe obesity (body mass index [BMI] ≥ 35 kg/m²), with rates as high as 36%

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for middle-aged non-Hispanic black women compared to 16% in their white counterparts [1]. Traditional methods of weight loss have not affected severe obesity, leading the healthcare community to turn to bariatric surgery. The most commonly performed procedure, Roux-en-Y gastric bypass (RYGB), is associated with durable weight loss, prolonged survival, and high rates of initial remission of type 2 diabetes mellitus, hypertension, and dyslipidemia [2,3].

Although research in this area has increased exponentially over the past 5 years, there are a number of limitations with the work to date and many areas in which there is little to no work published. For example, most publications on weight loss surgery present results from small, mainly non-Hispanic white samples [3]. These studies do not represent the large pool of severely obese patients eligible for surgery who are Hispanic or non-Hispanic black.

In addition, in the past 5 years a new “restrictive” procedure has begun to replace gastric banding because of its lower complication rates and superior weight loss outcomes [4]: vertical sleeve gastrectomy (SG). In preliminary, short-term studies, SG appears to result in weight loss and improvements in health conditions that are similar to those achieved with RYGB [5]. Long-term data on SG are lacking, however, and few surgical centers have performed significant numbers of cases to study outcomes. The largest investigations devoted to examining bariatric surgery, such as the Swedish Obese Patients study [6] and the U.S. Longitudinal Assessment of Bariatric Surgery [7], have no or few SG patients in their cohorts.

To address current gaps in the knowledge about bariatric surgery, we created a registry of patients having procedures for weight loss from 2004 to the present time in a large integrated healthcare system. This registry was also designed to monitor quality and safety outcomes and assist the clinical personnel responsible for the care of these patients. The purpose of this study is to describe the registry patient population, compare these general statistics to current U.S. national bariatric accreditation databases, provide statistics on weight regain over a 3-year period, and present 3-year comparative weight loss outcomes by gender and race/ethnicity for the 2 most common procedures in the world: RYGB and SG. Co-morbidity resolution in this registry population, an important outcome for bariatric surgery, has been published previously for type 2 diabetes [8,9] and metabolic syndrome and its components [10].

Methods

Setting

Kaiser Permanente Southern California (KPSC) consists of 3 elements: 1) healthcare insurance, 2) 14 hospitals and nearly 200 other medical offices to deliver ambulatory and inpatient care, and 3) a partnership of over 5,700 physicians. In addition to the care provided within the system, half of all bariatric procedures are performed at contract facilities with surgical teams from other medical groups. The details of weight loss surgery at KPSC have been published elsewhere [11]. Weight loss surgeries are performed in 10 different hospital facilities by 13 surgeons. All but 3 of these facilities are members of either the American Society for Metabolic and Bariatric Surgery (ASMBS) and/or the American College of Surgeons (ACS) accreditation systems.

Participants

Eligibility criteria for weight loss surgery at KPSC are based upon national recommendations [12]. These include having a BMI of 40 kg/m² or more with or without obesity-related co-morbid conditions or having a BMI of 35–39 kg/m² and at least 1 obesity-related co-morbid condition such as diabetes, hypertension, and/or sleep apnea. If patients meet these criteria, they can still be excluded from eligibility if they have any other major contraindication as determined by the bariatric surgeon.

Patients with the following characteristics are passively enrolled in the KPSC bariatric surgery registry: a surgical procedure for weight loss after January 1, 2004 and actively enrolled in the health plan at the time of surgery. These are the only enrollment criteria. Patients remain in the cohort even if they are no longer members of the health plan. A broad study protocol to collect all registry data for the purposes of surveillance was approved by the organization's Institutional Review Board for Human Patients.

Bariatric surgical case ascertainment and verification for the KPSC bariatric registry is done in a stepwise fashion from a variety of sources. The primary source is electronic reports from patient care managers at both system hospitals and contracted medical groups. These are compared to and augmented by internal electronic medical records and outside medical claims databases, which are considered secondary data sources. If there is disagreement between the primary and secondary sources or the bariatric surgery case only exists in a secondary source, it is manually chart reviewed for confirmation. The KPSC bariatric registry contains 20,296 patients (through May 31, 2013), 3% of whom have had revisions. The majority of these revisions are either laparoscopic band removals or laparoscopic band removals converted to either a SG or RYGB.

Measures

Demographic characteristics. Date of birth, race/ethnicity, and gender were obtained from electronic membership information. This information is collected from patients when they enroll in the health plan. Race/ethnicity is also collected using a self-report form when patients have an inpatient and/or outpatient visit. Income is assigned to members based upon the correspondence of 2010 U.S. census block information and their current address at the time of surgery [13].

Weight, height, and BMI. Height, weight, and BMI information are obtained from the electronic medical record and outside contract medical groups who perform the surgeries. In general, height is measured or self-reported by the patient and weight is measured by clinical staff. BMI is calculated after height and weight are obtained from these sources.

Readmissions. Readmissions are defined as an inpatient encounter 7 days or more after discharge from the bariatric

procedure. This is done to ensure that the inpatient encounter was a readmission and not associated with the original bariatric surgery inpatient stay. Readmissions are assessed for 30 days and yearly after surgery.

Death. To determine mortality, bariatric patients are linked through social security numbers, names, dates of birth, and addresses to the state and national death index databases, and then date and cause of death are abstracted.

Analyses

The KPSC bariatric registry data are descriptively compared (without using statistics) to data from 2 large accrediting bodies for bariatric surgery: the ASMBS and the ACS. The data for the ASMBS have been published from their Bariatric Outcomes Longitudinal Database (BOLD) [14], and data for the ACS have been published from the Bariatric Surgery Center Network (BSCN) [15] reporting database.

Weight outcomes are presented as percent excess weight loss using a BMI of 25 kg/m² as the “ideal”. This is the recommended method to determine changes in weight after bariatric surgery [16]. This was calculated using the following formula: $(\text{BMI at surgery} - \text{BMI at time of follow-up}) / (\text{BMI at surgery} - 25 \text{ kg/m}^2) * 100$. We present data for the number of patients who achieved 100%, 50%, and 0% or less percent excess weight loss 1 and 3 years postsurgery. Although many of the definitions of successful weight loss exist, depending upon the procedure, it is generally agreed that patients who achieve and maintain at least 50% excess weight loss are successful [17]. A percent excess weight loss of 0 or less (negative numbers) refers to patients who did not lose any weight or gained weight relative to their weight at the time of surgery. A percent excess weight loss of 100 or more refers to patients who lost all of their excess weight or more.

To compare percent excess weight loss across time between procedure types, racial/ethnic minority groups, and gender, a mixed Analysis of Covariance was performed with procedure (SG, RYGB), gender (men, women), and racial/ethnic minority group (non-Hispanic white, non-Hispanic black, and Hispanic) as between patient factors and a repeated measure of time (at surgery, 6, 12, 24, and 36 mo after surgery). Covariates were patient age and BMI at the time of surgery. Banding procedures were not included in the analyses due to the small sample size and rapid decline in use of this procedure worldwide [4]. Other racial/ethnic groups were too small to include in the analyses and included Asian, Pacific Islander, Native American, Alaskan Native, and mixed race.

Results

Comparison to national quality monitoring

Descriptive quality data for the KPSC bariatric registry are presented in Table 1 with findings from published

results of the ASMBS BOLD [14] and the ACS BSCN [15] accreditation databases as comparisons. The KPSC bariatric registry has similar RYGB (58%) and more SG (40%) procedures than the ASMBS BOLD (54% and 3%, respectively) and the ACS BSCN (55% and 2%) databases. Conversely, it has fewer gastric bypass procedures (2%) compared to either database (43% and 40%, respectively). In addition, the KPSC bariatric registry has a higher proportion of Hispanic patients (35%) than either database (12% and 6%, respectively) and more non-Hispanic black patients (18.5%) than the ACS BSCN accreditation database (11%). The KPSC bariatric registry distribution of women, average age, BMI distribution at the time of surgery, average length of stay, mortality rates, and 30-day readmission rates are all similar to the national databases.

The rate of missing weight at 1 year of follow-up for the KPSC bariatric registry was 22% for RYGB, 19% for banding procedures, and 14% for SG (see Table 2). These rates increased at 3 years to 27% for RYGB and 22% for SG, and remained stable for banding procedures (18%). The only data available for comparison from the national quality databases are those for 1-year follow-up in the ACS BSCN accreditation database. The rates of missing weight for these same procedures at 1-year follow-up were 29% for RYGB, 30% for SG, and 26% for banding procedures [15].

Weight loss outcomes

Overall summary. Weight loss outcomes in this population are shown in Table 2 and vary widely by procedure. One year after surgery, patients who had RYGB lost 91.8 ± 33.1 lbs and had a median 66.5% excess weight loss (range -42% to 149%). This was more than both patients having banding procedures who lost an average 41.5 ± 26.9 lbs with a median 37% excess weight loss (range -66% to 105%), and SG patients who lost an average 66.7 ± 32.4 lbs with a median 56% excess weight loss (-43% to 139%). The SG patients lost more weight than the patients having banding procedures at 1 year postsurgery. Results were similar at 3 years postsurgery with the gap between SG and patients with banding procedures narrowing (banding was 44.0 ± 33.3 lbs lost and 39% excess weight loss versus SG 57.6 ± 38.9 lbs lost and 46% excess weight loss).

Weight regain. Patients having RYGB also had higher rates of successful percent excess weight loss (defined as $\geq 50\%$) compared with patients having banding procedures or SG. At 1 year postsurgery, 81% of RYGB patient had achieved at least 50% excess weight loss compared to 33.5% of those with bands and 60% of SG patients. After 3 years, this difference was somewhat attenuated but still clear (65% of RYGB patients maintained at least 50% excess weight loss compared to 40% of band and 46% of SG patients). Very few patients, regardless of type of surgery, gained all of their weight back (range <1–10%).

Table 1

Comparison of the Kaiser Permanente Southern California (KPSC) bariatric registry patients from a large integrated healthcare system with other national longitudinal cohorts of bariatric patients. Current registry patients for this table are those actively enrolled in the health plan as of May 31, 2013 and who have only had 1 primary bariatric procedure. Revisional procedures are not included for comparison. Comparison patients are from the American Society for Bariatric and Metabolic Surgery (ASMBS) Bariatric Outcomes Longitudinal Database (BOLD) [1,2] and the American College of Surgeons' Bariatric Surgery Center Network (ACS BSCN) [3]. Patients in the registry have had surgery at both ASMBS- and ACS-accredited surgical centers.

	Bariatric registry (n = 19,651)	ACS BSCN (n = 28,616)	ASBMS BOLD (n = 57,918)
Yr of coverage	2004–May 31, 2013	2007–2010	2007–2009
Procedure type			
RYGB	58% (n = 11,422)	54% (n = 15,479)	55% (n = 31,668)
SG	40% (n = 7,781)	3% (n = 944)	2% (n = 1,328)
Gastric banding	2% (n = 388)	43% (n = 12,193)	40% (n = 22,947)
Other	<1% (n = 60)	—	3% (n = 1,842)
% Women	80% (n = 15,761)	78% (n = 22,293)	79% (n = 45,619)
Racial/Ethnicity			
Non-Hispanic Caucasian	39% (n = 7,712)	77% (n = 21,946)	78% (n = 45,248)
Hispanic	35% (n = 6,796)	12% (n = 3,341)	6% (n = 3,489)
Non-Hispanic black	18.5% (n = 3,635)	NA	11% (n = 6,094)
Other	3% (n = 607)	NA	6% (n = 3,351)
Unknown/Missing	5% (n = 901)	NA	NA
Age (yr)	44.6	45.2	46.7
BMI (kg/m ²)			
<40	20% (n = 3,927)	22% (n = 6,344)	19% (n = 11,233)
40–49.9	56% (n = 10,980)	54% (n = 15,575)	53% (n = 30,962)
50–59.9	19% (n = 3,776)	18% (n = 5,234)	21% (n = 12,007)
60+	5% (n = 968)	4% (n = 1,282)	6% (n = 3,512)
Length of stay (d)	2.5	2.5	2.5
Mortality rate			
30 d	0.1% (n = 22)	0.1% (n = 35)	.09% (n = 22)
1 yr	0.3% (n = 59)	0.25% (n = 72)	NA
Readmission rate			
30 d	5% (n = 833)	4.5% (n = 1,289)	3.5% (n = 1,759)
1 yr	13% (n = 2,567)	NA	NA

BMI = body mass index; LAGB = laparoscopic adjustable gastric banding; RYGB = Roux-en-Y gastric bypass; SG = vertical sleeve gastrectomy

Effects of gender, race/ethnicity, and procedure type. Fig. 1 and Fig. 2 show results for percent excess weight loss by procedure, gender, and race/ethnicity. Three-year rates of missing weight for the gender and procedure groups shown in Fig. 1 were as follows: RYGB women 20%, RYGB men 28%, SG women 18%, and SG men 28%. Women had higher rates of follow-up than men (20% versus 28%; $P < .001$) regardless of procedure. Three-year rates of missing weight for the race/ethnicity and procedure groups shown in Fig. 2 were as follows: RYGB non-Hispanic white 22%, RYGB Hispanic 22%, RYGB non-Hispanic black 19%, SG non-Hispanic white 21%, SG Hispanic 23%, and SG non-Hispanic black 17%. Non-Hispanic black patients had lower rates of missing weight at 3 years (18%) compared with both non-Hispanic white (22%; $P = .003$) and Hispanic (22%; $P = .002$) patients, regardless of procedure. There were no differences between procedures in rates of follow-up at 3 years.

RYGB patients lost more weight at every time point after surgery compared with SG patients (Fig. 1; $P < .001$). Women had similar percent excess weight loss to men at 6 months postsurgery; however, at all subsequent time points women had higher percent excess weight loss than

men (Fig. 1; $P < .001$). For RYGB patients, non-Hispanic white patients had consistently higher percent excess weight loss than non-Hispanic black ($P < .001$) and Hispanic ($P < .001$) patients across all time points. From 6–24 months postsurgery, Hispanic RYGB patients had higher percent excess weight loss than non-Hispanic black RYGB patients ($P < .001$), however, this difference was not present at 3 years. No differences between racial/ethnic groups in percent excess weight loss at any time point were seen for SG patients.

Discussion

This KPSC bariatric registry represents a unique collaboration between clinical systems of care and research. Patients are very similar to national published findings from a variety of settings, primarily academic research centers [5,14,15,18] with the exception that there are a much higher proportion of ethnic/racial minorities (53%; primarily non-Hispanic black and Hispanic) in the KPSC bariatric registry than other published work [5,14,15,18]. Independent of age and BMI at the time of surgery, we found that RYGB patients had higher weight loss

Table 2

Summary of weight-related outcomes for Kaiser Permanente Southern California (KPSC) bariatric surgery registry patients. Patients in this table are those actively enrolled in the health plan as of May 31, 2013, who have only had 1 primary bariatric procedure, and who had their surgery at least 3 years before May 31, 2013.

	1 yr	3 yr
Roux-en-Y gastric bypass (open and lap) (n = 6,977)		
Sample size with weight	n = 5,476	n = 5,088
Rates of missing weight [†]	22% (n = 1,501)	27% (n = 1,889)
Due to lost membership	49% (n = 729)	77% (n = 1,462)
BMI reductions (kg/m ²)	15.0 ± 5.1	13.3 ± 6.1
Weight loss (lbs)	91.8 ± 33.1	81.5 ± 38.3
Median %EWL* (range)	66.5% (-42% to 149%)	59% (-60% to 136%)
% Patients ≥ 100% EWL	7% (n = 384)	5.5% (n = 280)
% Patients ≥ 50% EWL	81% (n = 4,434)	65% (n = 3,296)
% Patients ≤ 50% EWL	19% (n = 1,042)	35% (n = 1,792)
% Patients ≤ 0% EWL [‡]	<1% (n = 16)	<1% (n = 36)
Banding Procedures (n = 202)		
Sample size	n = 164	n = 165
Rates of missing weight [†]	19% (n = 38)	18% (n = 37)
Due to lost membership	71% (n = 27)	76% (n = 28)
BMI reductions (kg/m ²)	6.8 ± 4.4	7.3 ± 5.4
Weight change (lbs)	41.5 ± 26.9	44.0 ± 33.3
Median %EWL* (range)	37% (-66% to 105%)	39% (-73% to 121%)
Banding procedures (n = 202)		
% Patients ≥ 100% EWL	1% (n = 2)	5% (n = 8)
% Patients ≥ 50% EWL	33.5% (n = 55)	40% (n = 66)
% Patients ≤ 50% EWL	66% (n = 109)	60% (n = 99)
% Patients ≤ 0% EWL [‡]	4% (n = 6)	8% (n = 13)
Vertical sleeve gastrectomy (n = 1,079)		
Sample size	n = 929	n = 839
Rates of missing weight [†]	14% (n = 150)	22% (n = 240)
Due to lost membership	62% (n = 93)	72% (n = 172)
BMI reductions (kg/m ²)	11.0 ± 4.9	9.4 ± 6.0
Weight change (lbs)	66.7 ± 32.4	57.6 ± 38.9
Median %EWL* (range)	56% (-43% to 139%)	46% (-87.5% to 145%)
% Patients ≥ 100% EWL	3% (n = 31)	3% (n = 24)
% Patients ≥ 50% EWL	60% (n = 556)	46% (n = 384)
% Patients ≤ 50% EWL	40% (n = 373)	54% (n = 455)
% Patients ≤ 0% EWL [‡]	1% (n = 10)	4% (n = 30)

BMI = body mass index; %EWL = percent excess weight loss.

*%EWL calculated as (BMI at surgery - BMI at time of resolution or the end of follow-up)/(BMI at surgery - 25 kg/m²) × 100. Negative numbers reflect weight gain above the weight at the time of surgery.

[†]Missing weight could be due to 2 factors: lost membership during follow-up or being a current member, but not having an in person visit at which weight was measured; or weight was recorded in a text field, which cannot be retrieved electronically.

[‡]≤ 0 %EWL refers to patients who had no weight loss or weight gain above the weight at the time of surgery.

throughout the 3-year follow-up period compared to SG patients, women had greater percent excess weight loss than men at later follow-up periods, and that race/ethnicity was significantly related to weight loss after RYGB surgery but not SG. Specifically, for RYGB patients, non-Hispanic white patients had consistently higher percent excess weight loss than non-Hispanic black and Hispanic patients across

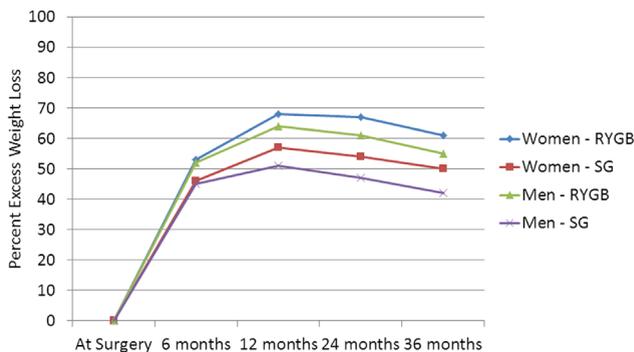


Fig. 1. Percent excess weight loss by gender (women and men) and procedure (Roux-en-Y gastric bypass [RYGB] and vertical sleeve gastrectomy [SG]). Three-year rates of missing weight were as follows: RYGB women 20%, RYGB men 28%, SG women 18%, and SG men 28%.

all time points. From 6–24 months postsurgery, Hispanic patients had higher percent excess weight loss than non-Hispanic black patients; however, this difference was not present at 3 years.

There have been a number of reviews [18–20] and meta-analyses [3,21,22] detailing the effects of various bariatric procedures on weight loss. There is a great deal of variability in weight loss with each procedure. Mechanick et al. [18] published a summary table of weight loss findings across 85 studies from 1982–2007, which illustrated this variability. The range in percent excess weight loss for banding procedures after 1–2 years postsurgery was 29–87%; for RYGB was 48–85%; and for SG was 33–58%. In comparison to this literature summary, at 1 year postsurgery, our KPSC bariatric registry patients had mid-range percent excess weight loss for RYGB (67%), low range for banding procedures (34%), and high range for SG (58%).

There are very limited findings published on weight regain in patients. For the Swedish Obese Patients study [6],

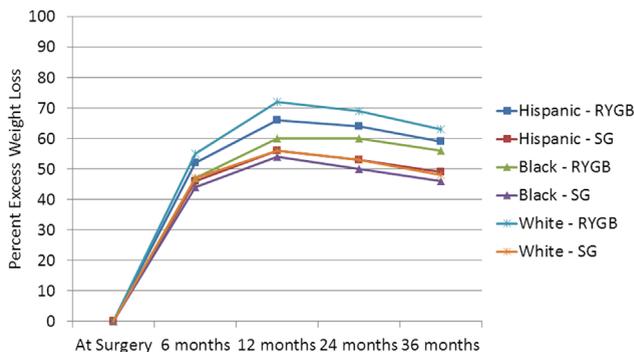


Fig. 2. Percent excess weight loss by race/ethnicity (non-Hispanic black and white and Hispanic) and procedure (Roux-en-Y gastric bypass [RYGB] and vertical sleeve gastrectomy [SG]). Three-year rates of missing weight were as follows: RYGB non-Hispanic white 22%, RYGB Hispanic 22%, RYGB non-Hispanic black 19%, SG non-Hispanic white 21%, SG Hispanic 23%, and SG non-Hispanic black 17%.

all patients lost a substantial amount of weight (up to 45 kg for gastric bypass) and after 8 years had regained an average of 7–14 kg. There were wide confidence intervals (± 10 kg) for each time point, especially for gastric bypass patients. However, all surgery patients were substantially below their starting weight 8 years after surgery. Mitchell et al. [23] reported that 3 of their 78 RYGB patients had gained weight above their presurgical weight at 15 years postsurgery. It is difficult to compare the KPSC bariatric registry weight regain data to these findings, however, very few of our patients regained all of their weight back after 3 years (< 1 – 10%). As with the literature, there was a great deal of variability in response to surgery. For 3-year outcomes the range in percent excess weight loss was -60% to 136% for RYGB, -73% to 121% for banding procedures, and -87.5% to 145% for SG (negative values representing weight gain above surgical weight). This variability presents an important opportunity for study.

To date, there is only limited evidence of how preoperative patient characteristics predict outcomes of RYGB and almost nothing is known about how patient-level factors predict SG outcomes. There is support for the fact that higher BMI and older age at the time of surgery predict greater operative risks [24], weight loss [25,26], and disease resolution [27]. The literature is equivocal for gender with some reports stating that men and women have equal weight loss [28] or men have more weight loss than women [29], but with higher operative risk. [24]. A recent meta-analysis concluded that the few small studies done with racial/ethnic minorities had non-Hispanic black patients losing less weight at 1 year postsurgery compared with their white counterparts [30] and that these differences persisted regardless of bariatric procedure. In comparison to this meta-analysis, we found that there were ethnic/racial minority differences for RYGB weight loss but not SG. Our disparate findings could be explained in part by the fact that the meta-analysis reviewed RYGB and banding procedures, whereas we examined SG as the comparison restrictive procedure.

Although we are one of the first studies to show poorer weight loss outcomes for Hispanic and non-Hispanic black RYGB patients, the nonsurgical weight loss literature has support for the fact that culture plays a part in a person's ability to lose weight [31]. Although surgery is a powerful tool for massive weight loss, especially in the first 6 months postsurgery, patients must still change lifestyle habits to continue to lose weight and maintain that weight loss in the long term. There are a number of barriers uniquely faced by Hispanic and non-Hispanic black cultures in changing health habits related to weight loss and maintenance. These include eating with extended families and community groups, making it difficult to make an individual choice to eat differently [32], cultural values of beauty that regard larger body types in women and thus discourage losing weight [33], and poor availability of healthy foods and

opportunities for physical activity in low-income neighborhoods, where minority populations are concentrated [34].

It is not clear why we found no differences between racial/ethnic groups in weight loss with SG. In our previous work with metabolic syndrome in this same cohort of patients [10], we found that SG patients were less likely to have diabetes and hypertension at the time of surgery compared with RYGB patients. We also found that fewer non-Hispanic black patients received RYGB surgery compared with other patients. It is possible that ethnic/racial minorities will have a higher disease burden when they have surgery compared with their white counterparts, and that this will lead surgeons to choose RYGB for these patients because there is more evidence that this procedure is effective for co-morbidity resolution. However, paradoxically, we have shown that patients with a higher and more severe disease burden are less likely to experience resolution of their diabetes [8,9], presumably in part because they do not lose as much weight as their healthier counterparts. Clearly further in-depth study is needed to understand how disease burden and severity interact with patient characteristics in determining a patient's response to a particular bariatric procedure.

There are a number of limitations with the KPSC bariatric registry data when used for observational research. The main limitation is the rate of missing weight at 3 years of follow-up, which was 27% for RYGB, 18% for banding procedures, and 22% for SG. Attrition rates vary widely in the literature from 49–89% [18]. Missing weights in the KPSC bariatric registry are primarily due to patients losing their healthcare coverage. Because we rely on passive surveillance of electronic medical records, we are more susceptible to factors such as missed appointments and lost patient contact than research studies that have active surveillance of participants. Despite this limitation, our weight loss follow-up rates are better than those reported by the ACS BSCN accreditation database ($\sim 30\%$ at 1 yr) [15].

The KPSC bariatric surgical quality program includes nurse care managers and active follow-up of patients, which improves the chances that we obtain weights after surgery. However, this is primarily focused on laboratory monitoring and phone counseling for prevention of emergency visits and inpatient readmissions. Phone visits are more cost-effective than in-person visits; unfortunately, this means we do not obtain weights for these patients. Laboratory tests are not done in an outpatient setting and thus do not require assessment of weight.

Another major limitation of passive surveillance is that there is no systematic collection of patient-reported outcomes such as diet, physical activity, or quality of life in these patients. These indicators have been shown to have a strong effect on surgical outcomes for bariatric patients [35,36]. Thus, any study with these variables as key outcomes would need to collect this data prospectively and collection of baseline data would be difficult. We have

been working with the clinical systems that use the registry to incorporate patient-reported outcomes such as quality of life in the electronic medical record; however, implementation of this process will take several years.

Despite these limitations, there are a number of strengths inherent to the KPSC bariatric registry. This is one of the largest bariatric surgery cohorts in the literature, especially with respect to the SG procedure and ethnic/racial minorities, with a stable population containing long-term information on healthcare utilization. The registry has a combined sample size that is over 20 times the number of SG and RYGB patients that have been directly compared in all case series and controlled trials to date. Despite higher rates of missing follow-up weight information compared with patient populations followed specifically for research purposes, we have better follow-up than national accreditation organizations, and we have the ability to control for factors contributing to missing data in our analyses because of the richness of our integrated electronic medical record.

We also have at least 1 year of baseline information about weight, health conditions, and healthcare utilization and can thus study factors that predict weight loss success that are not available in many controlled trials or national surveillance cohorts. Many studies in this area have limited baseline information and this is often only at the time of surgery. We are not arguing that passive surveillance should replace randomized clinical trials; however, such a large population-based cohort in a real-world clinical setting can provide a wealth of information about these patients that can be generalized to a variety of settings, informing the design of clinical trials in this area.

Conclusion

The bariatric KPSC bariatric registry described in the present study allows us to work more closely with healthcare providers to facilitate future studies and ensure that our findings are translated into clinical practice in a timely fashion. We have shown that some patients may not have the same success with bariatric surgery as others (non-Hispanic black and male patients) and that this provides an opportunity to potentially develop postsurgical programs to improve their success rate. We have also shown that SG procedures do not result in the same level of weight loss as RYGB for a population-based, real world clinical sample of patients. Even though some patients may not be doing as well as others, the weight regain rate at 3 years is very low for this patient population (only 1–10% reach presurgical weight after 3 yr) and further supports the success of bariatric surgery for weight control in the severely obese.

Disclosures

The authors have no commercial associations that might be a conflict of interest in relation to this article.

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Editorial comment

Comment on: Three-year weight outcomes from a bariatric surgery registry in a large integrated healthcare system

In 1990, 12.7% of Americans were considered obese. Currently, over 35% of the U.S. population is obese, and the numbers are expected to grow over the next 2 decades with prevalence projected to reach 42% by 2030 [1]. Along with the dramatic increase in obesity, bariatric surgery saw a similar rise with over 200,000 procedures being performed annually in the United States by the end of 2007. This exponential growth in bariatric surgery led to significant concerns about the quality and safety of the operations. Indeed, the discipline faced intense scrutiny in the mid-2000s by the media and our peers [2,3].

To answer these concerns, as well as to set standards and establish evidence-based guidelines for best clinical practices and quality improvement, the American Society for Metabolic and Bariatric Surgery and the Surgical Review Corporation launched Bariatric Outcomes Longitudinal Database (BOLD) in 2007. Around the same time, American College of Surgeons developed the Bariatric Surgery Center Network (BSCN) data collection system, with similar goals in mind. Today, these 2 databases represent the largest repositories of bariatric surgery patients,

with >500,000 patients in BOLD database and over 113,000 patients in the BSCN database.

In this issue of the journal, Coleman et al. have compared the Kaiser Permanente Southern California (KPSC) bariatric registry with BOLD and BSCN, and offer 3-year weight loss outcomes. What makes the KPSC bariatric registry unique is its composition. Besides being one of the largest cohorts of bariatric surgery patients ($n = 20,296$), the KPSC database contains a much larger percentage of ethnic minorities (>50%) than BOLD or BSCN. Additionally, the KPSC database has a breakdown of procedures similar to today's bariatric surgery trends, with 58% of the patients undergoing Roux-en-Y gastric bypass (RYGB), 40% having sleeve gastrectomy (SG), and only 2% having a banding procedure.

The analysis by Coleman et al. of the KPSC registry has reconfirmed, albeit in a more diverse patient population, what was already known in respect to percent excess weight loss (%EWL) for each procedure (i.e., RYGB patients experience a higher %EWL than SG patients, and banded patients have the lowest %EWL.) However, in-depth analysis by the authors has revealed some interesting