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ORIGINAL CONTRIBUTIONS

The Bariatric Experience Long Term (BELONG): Factors Related to Having Bariatric Surgery in a Large Integrated Healthcare System

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Abstract

Purpose Bariatric surgery is the most effective treatment for severe obesity, but currently, only 1–2% of all eligible patients undergo surgery each year. This study examined which factors were associated with a patient receiving bariatric surgery after referral in a real-world healthcare setting.

Materials and Methods The current study used the baseline survey and electronic medical record (EMR) data from the Bariatric Experience Long Term (BELONG) study ($n = 1975$). Predictors of who did ($n = 1680$) and who did not ($n = 295$) have surgery were analyzed using multivariate logistic regression.

Results Participants ($n = 1975$; 42.4% response rate) were primarily women (84%) and either non-Hispanic Black or Hispanic (60%). In the fully adjusted multivariate model, the strongest predictors of having surgery were being a woman (OR = 3.17; 95% CI = 2.15, 4.68; $p < .001$) and losing at least 5% of their body weight in the year before surgery (OR = 3.16; 95% CI = 2.28, 4.38; $p < .001$). The strongest predictors of not having surgery were a ≥ BMI 50 kg/m^2 (OR = .39; 95% CI = .27, .56; $p < .001$) and having a higher physical comorbidity burden (OR = .84; 95% CI = .75, .94; $p = .004$).

Conclusions Practices such as 5–10% total weight loss before surgery and selection of patients with safer operative risk profiles (younger with lower comorbidity burden) may inadvertently contribute to under-utilization of bariatric surgery among some demographic subpopulations who could most benefit from this intervention.

Keywords Surgical decision-making · Health disparities · Gender differences

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Introduction

Bariatric surgery is the most effective treatment for severe obesity (body mass index [BMI] ≥ 35 kg/m^2), but currently, only 1–2% of all eligible patients undergo bariatric surgery each year [1–4]. The reasons for this low uptake are likely multifactorial and include both patient- [5–8] and provider-level [6, 9, 10] factors. Most of the research in this area has focused on data that are readily available in electronic databases such as race/ethnicity, gender, insurance coverage, income and education, comorbidity burden, and BMI [11, 12]. There is very little work related to psychosocial determinants. Some of the work that has been done in this area suggested that patients perceive surgery as an extreme treatment for obesity with too many risks [7] and having surgery is highly stigmatized resulting in discrimination and loss of social networks [8].

The main goal of this study was to examine health, behavior, demographic, and psychosocial factors associated with having bariatric surgery in a population that had been referred for surgery. This study used the baseline survey for a larger longitudinal cohort study, the Bariatric Experience Long Term (BELONG). The BELONG cohort was formed using the literature to date for predictors of weight loss after bariatric surgery [13–24]. Based upon this literature base, we hypothesized in the current study that both (1) patients who had < 5% total weight loss (TWL) in the year before surgery and (2) those who had a body mass index (BMI) ≥ 50 kg/m^2 at the time of surgery would be less likely to have surgery than those who lost more weight and/or had a BMI < 50 kg/m^2. We also hypothesized that the following patients would be less likely to have surgery: male patients, those with lower annual income, those from racial/ethnic minority groups, and those with a higher physical and psychiatric comorbidity burden. We also explored the association between having bariatric surgery and (1) preoperative adherence to scheduled routine care visits, (2) health literacy, (3) self-reported pain and dysfunction, and (4) the use of weight control strategies.

Materials and Methods

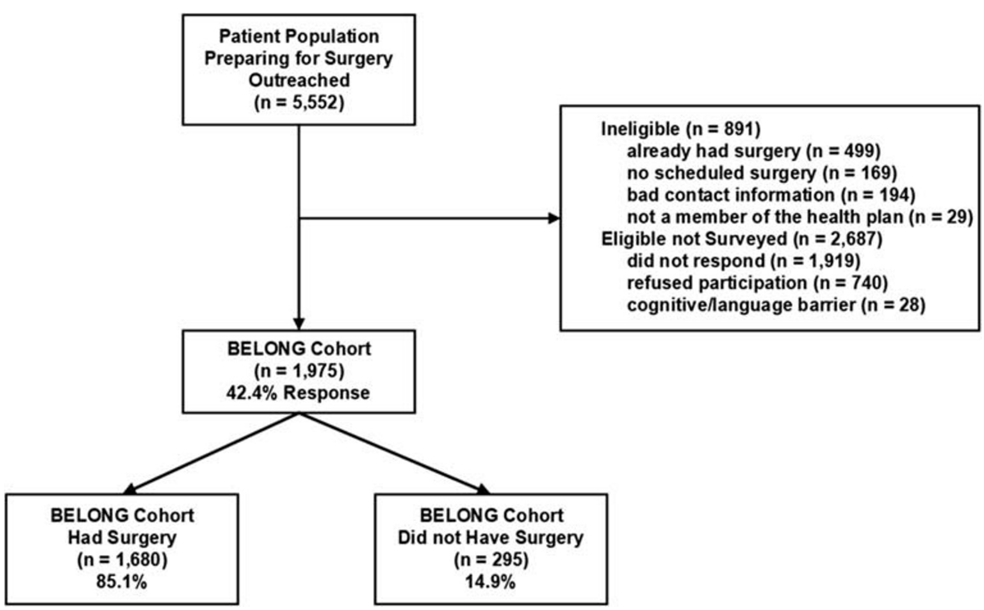
Participants

This current study reports on the pre-surgical baseline survey and EMR-based findings for the BELONG study participants (n = 1975) who were members of Kaiser Permanente Southern California at the time of the survey. Eligibility criteria for inclusion in the BELONG study were (1) being enrolled in a 12-week bariatric surgery preparation course, (2) planning to have their first bariatric procedure within 6 months of the baseline survey, (3) being an adult 18 years of age and older, and (4) meeting general eligibility criteria for weight loss surgery in the USA [25]. Figure 1 outlines the recruitment pathway for the study and details of recruitment are provided in the Appendix.

Survey

The baseline survey for the BELONG study was administered using a Computer-Aided Telephone Interview (CATI) system or a self-directed website and took approximately 75 min to complete. The baseline survey was for research only and was not used in a patient's preparation/decision process for surgery. Almost half (n = 978; 49.5%) of all participants

Fig. 1 Sample selection for the Bariatric Experience Long Term (BELONG) study



completed the baseline survey using the website. The survey is available upon request and an overview of the constructs included in the survey is provided in the Appendix.

Electronic Medical Record

The electronic medical record (EMR) was used to determine eligibility for the BELONG study. These data were abstracted at the time of the baseline survey or at the time of surgery. For this current study, we abstracted diagnoses and pharmacy records to determine disease burden, adherence to scheduled visits for routine medical care in the 12 months before surgery/survey, weight and height to determine both body mass index (BMI) and % TWL in the 12 months before surgery/survey, and date of birth to calculate age.

Chart Abstraction

Chart abstraction was done to determine why survey participants did not have surgery ($n = 295$). This chart review was done by author KJC and research personnel using a standard protocol. The protocol was used to review surgical consult notes, patient communication through emails and telephone calls, and outpatient visit notes with other healthcare providers. Relevant text was used to classify reasons why survey participants did not have surgery: (1) did not meet required criteria, (2) did not meet recommended criteria (please see the Appendix for a description of required and recommended criteria), (3) other reasons, and (4) indeterminant. A random sample of 10% of participants ($n = 30$) was coded by both reviewers and percent agreement was calculated. If agreement was less than 80%, cases were discussed and modifications to the review protocol were made when necessary.

Analyses

Descriptive statistics were calculated as means ± standard deviations for continuous variables and frequencies for categorical variables. Univariate comparisons of EMR and survey-derived variables between patients who had surgery ($n = 1680$) and those who did not ($n = 295$) were done using independent sample *t* tests for continuous variables and the Chi-square statistic for categorical variables. For the univariate comparisons between patients who did and did not have surgery, significance levels were adjusted for multiple comparisons using a modified Bonferroni procedure. Predictors of who did and did not have surgery for the multivariate logistic regression were chosen based upon significant univariate tests ($p \leq .001$).

Results

Participants

Survey participants ($n = 1975$; 42.4% response rate) were primarily women (84%), either non-Hispanic Black or Hispanic (60%), with a BMI of 45.1 ± 7.4 kg/m^2, age 43.3 ± 11.5 years, and 19% had at least two comorbidities. Table A1 in the Appendix provides univariate summary statistics for all the variables used to compare survey participants who did ($n = 1680$) and did not ($n = 295$) have surgery. Table 1 only presents the findings for those factors that were significant and were then used in the multivariate logistic regression.

Multivariate Differences

When the variables that were significantly different between survey participants who did and did not have surgery (see Table 1) were included in a multivariate logistic regression model, the following survey participants were significantly *more* likely to get surgery: (1) women (over three times more likely than men; OR = 3.17; 95% CI = 2.15, 4.68; $p < .001$); (2) those who lost at least 5% TWL in the year before surgery or the survey if they did not have surgery (over 3 times more likely than those who lost less than 5% TWL; OR = 3.16; 95% CI = 2.28, 4.38; $p < .001$); (3) those using "anticipating problems with their goals" as a weight control strategy (60% more likely than those who did not use this strategy; OR = 1.60; 95% CI = 1.10, 2.33; $p = .01$); (4) those having an annual income of $51,000 or more (52% more likely than those who made less than $51,000; OR = 1.52; 95% CI = 1.08, 2.13; $p = .02$); and (5) those having higher attendance at scheduled visits for routine medical care in the year before surgery/survey if they did not have surgery (3% more likely for each additional visit attended; OR = 1.03; 95% CI = 1.02, 1.04; $p < .001$). The following survey participants were significantly *less* likely to get surgery: (1) those with a BMI ≥ 50 kg/m^2 (61% less likely than those with BMI < 50 kg/m^2; OR = .39; 95% CI = .27,.56; $p < .001$); (2) those with a higher physical comorbidity burden (16% less likely for each additional comorbidity; OR = .84; 95% CI = .75,.94; $p = .003$); and (3) those who were older (2% less likely for each year increase in age; OR = .98; 95% CI = .96, .99; $p = .005$).

Chart Review

Of the 295 patients who did not have surgery, chart review identified that 105 (36%) did not meet the required criteria for surgery, 72 (24%) did not meet the recommended criteria for surgery (please see Appendix for criteria), 81 (27%) had other reasons unrelated to the criteria, 7 (2.4%) died before they got surgery, and for 30 (10%) survey participants, it was not possible to discern the reason why they did not have surgery. Among those who

Table 1 Characteristics for participants in the Bariatric Experience Long Term (BELONG) study who completed a baseline survey ($n = 1975$). Results are presented for those who went on to have surgery ($n = 1680$) and those who did not ($n = 295$). All variables were measured (1) at the time of surgery, (2) at the time of the baseline survey, or (3) for 12 months before surgery/survey. The source of the variables is also noted (electronic medical record [EMR] or survey)

	Surgery ($n = 1680$)	No surgery ($n = 295$)	p
Age (years) (EMR)	43.0 ± 11.4	45.7 ± 12.3	< .001
Gender (% women) (survey)	86% (1450)	71% (210)	< .001
Annual income (% ≥ $51,000) (survey)	59% (894)	48% (125)	.001
Socioeconomic status (range 8–67) (survey)	38.2 ± 12.5	35.0 ± 13.1	< .001
12-month attendance rate (range 0–100%) (EMR)	76% ± 11.9%	70% ± 13.3%	< .001
Health literacy (range 0–3) (survey)	2.9 ± .4	2.8 ± .5	< .001
Comorbidity burden (EMR)			< .001
0	37% (493)	21% (63)	
1	35% (473)	38% (112)	
≥ 2	28% (374)	41% (120)	
Total dysfunction (range 0–48) (survey)	9.3 ± 7.9	11.6 ± 8.5	< .001
Pain (range 3–15) (survey)	7.0 ± 3.1	7.7 ± 3.2	.001
12-month % total weight loss (% TWL) (EMR)	6% ± 5%	4% ± 4%	< .001
12-month ≥ 5% TWL (% yes) (EMR)	61.8% (1039)	33.9% (100)	< .001
Body mass index (BMI) kg/m^2 (EMR)	43.55 ± 6.77	47.29 ± 8.86	< .001
BMI ≥ 50 kg/m^2 (% yes) (EMR)	15% (255)	34% (100)	< .001
Motivations for surgery (% important/very important) (survey)			
Doctor-advised surgery	39% (611)	50% (140)	< .001
Others want me to have surgery	22% (368)	31% (89)	< .001
Average use of weight control strategies (range 0–4) (survey)	1.9 ± .8	1.7 ± .7	< .001
Weight control strategies (% used most of the time/always) (survey)			
Sets healthy eating goals	74% (1247)	59% (174)	< .001
Plans for problems that interfere with goals	52% (866)	40% (118)	.001
Makes daily/weekly exercise/meal plans	55% (913)	42% (123)	.001
Keeps record of behavior	53% (892)	38% (112)	< .001
Used a self-monitoring device in last 30 days (% yes) (survey)	64% (1070)	51% (149)	< .001

did not meet required criteria ($n = 105$), (1) 49% ($n = 51$) did not complete the pre-operative laboratory testing and medical and psychiatric exams; (2) 43% ($n = 45$) did not complete the 12-week preparation course; (3) 7% ($n = 7$) were current smokers or using drugs or alcohol; or (4) 2% ($n = 2$) did not have surgery within 12 months of their surgical consult. Not meeting recommended criteria was primarily due to (1) having a medical comorbidity burden and/or not having their medical conditions under control (44%; $n = 32$) both of which led to an assessment by the clinical team that they were too high risk for surgery (i.e., HbA1c too high, severe anemia, nutritional deficiencies, new conditions diagnosed such as severe kidney disease); (2) not losing at least 5% TWL before their surgical consult (42%; $n = 30$; 16 [53%] of these patients had a BMI ≥ 50 kg/m^2); or (3) having psychiatric comorbidities that were newly diagnosed or not adequately controlled (14%; $n = 10$; i.e., cognitive deficits, eating disorders, bipolar disorder).

The other reasons why survey participants did not have surgery ($n = 81$) were primarily related to patient choices/circumstances. These included (1) loss of insurance or inability to meet deductibles (31%; $n = 25$); (2) wanting to lose weight on their own (14%; $n = 11$); (3) having other surgeries first (11%; $n = 9$) such as kidney transplant or cancer treatment; (4) deciding they did not want to have surgery (10%; $n = 8$) primarily due to concerns about changes in lifestyle and excessive surgical risk; (5) inadequate support from family members for post-operative care and lifestyle changes (9%; $n = 7$); (6) having lost enough weight during the preparation course (7%; $n = 6$); (7) not being to accommodate the surgery and recovery time due to work (6%; $n = 5$); and (8) various other reasons (12%; $n = 10$) including pregnancy, religious beliefs regarding blood transfusions, and starting school.

Discussion

In this large survey of insured patients, the strongest determinants of having surgery were losing ≥ 5% TWL prior to surgery, being female, and having a BMI < 50 kg/m^2 at the time of surgery. Patients who had surgery were also more likely to be younger, have higher annual income, have a lower co-morbidity burden, use planning for problems as a weight loss strategy, and have higher attendance at scheduled visits for routine care in the previous year (see Table 2 for a summary of these findings). These findings are consistent with past findings on disparities by gender and socioeconomic status [1–5, 26, 27]. Even though all participants in our study had insurance coverage at the time of the survey, 8% ($n = 25$) of the participants who did not go on to have surgery did so because they either lost their insurance or could not meet their deductibles for surgery. This finding also lends support to insufficient health care coverage being a barrier to receiving surgery [1, 2].

In contrast to much of the literature in this area [1–4, 27], there was no evidence that survey participants who were members of a racial/ethnic minority were less likely to receive surgery. It is possible this is due to the healthcare system in which the study was done. Kaiser Permanente Southern California serves a majority minority patient population and has developed many initiatives and efforts to improve the cultural competence of its providers [28–30]. Initiatives focused on systematic reasons for health disparities could be an effective way to reduce racial/ethnic minority access to bariatric surgery.

Our study is one of the first to report several factors associated with having bariatric surgery that have not been examined to date. These include %TWL in the year before surgery/survey and having a BMI ≥ 50 kg/m^2. The importance of weight loss before surgery for operative safety and post-operative "success" is controversial. In general, there is better support for the link between operative safety and preoperative weight loss when the patient's BMI is ≥ 50 kg/m^2 [2, 31] or weight gain before surgery [31, 32]. However, the evidence for recommending weight loss in patients with BMI less than 50 kg/m^2 and the link to safety and long-term weight and health outcomes has little evidence [33, 34].

Similarly, we found that patients with a higher comorbidity burden and/or conditions that were not well-controlled were less likely to receive surgery. Although there is evidence that patients with higher comorbidity burden at surgery may be at greater operative short-term risk [35], research is still needed to understand the risk of operative complications and mortality relative to the substantial improvements in longevity and co-morbidity resolution [36, 37]. This work could help patients weigh the risks and benefits of bariatric surgery and provide them with evidence to advocate for this durable treatment.

In addition, we found that older patients were less likely to receive surgery. This could also be related to the perception

Table 2 Results of multivariate logistic regression predicting the odds of having bariatric surgery in the Bariatric Experience Long Term (BELONG) study using electronic medical record (EMR) or survey variables that were significant in univariate comparisons (see Table 1). All variables were measured (1) at the time of surgery, (2) at the time of the baseline survey, or (3) for 12 months before surgery/survey

	β	S.E.	Wald	p	OR	95% CI lower	95% CI upper
Age (years)	− .02	.01	7.93	.005	.98	.96	.99
Gender (% female)	1.16	0.20	34.08	< .001	3.17	2.15	4.68
Income (% ≥ $51,000)	.42	.17	5.79	.02	1.52	1.08	2.13
Socioeconomic status (range 8–67)	.01	.01	3.17	.08	1.01	.999	1.03
12-month attendance rate (range 0–100%)	.03	.01	18.21	< .001	1.03	1.02	1.04
Health literacy (range 0–3)	.13	.19	.49	.49	1.14	.79	1.64
Physical comorbidity burden	− .18	.06	8.78	.003	.84	.75	.94
Total dysfunction (range 0–48)	.01	.01	.40	.53	1.01	.98	1.03
Pain (range 3–15)	− .03	.03	1.05	.31	.97	.91	1.03
12-month lost ≥ 5% TWL	1.15	.17	47.23	< .001	3.16	2.28	4.38
BMI % ≥ 50 kg/m^2	− .94	.19	25.34	< .001	.39	.27	.56
Motivation to have surgery: doctor advice	− .31	.17	3.45	.06	.73	.53	1.02
Motivation to have surgery: for others	.39	.20	3.76	.05	1.47	.996	2.18
Average use of weight control strategies (range 0–4)	− .25	.15	2.71	.10	.78	.58	1.05
Weight control strategy: healthy eating goals	.36	0.19	3.48	0.06	1.43	.98	2.09
Weight control strategy: planning for problems	.47	.19	6.10	.01	1.60	1.10	2.33
Weight control strategy: making a meal/exercise plan	.09	.20	.19	.67	1.09	.74	1.61
Weight control strategy: recording behavior	.21	.20	1.11	.29	1.23	.84	1.80
Used a self-monitoring device in the last 30 days	.11	.17	.41	.52	1.12	.80	1.56

that older adults have higher comorbidity burden and overall surgical risk; however, a recent study suggests that older adults can benefit greatly from bariatric operations without greater complication and mortality rates [38]. Finally, we are one of the few studies to show that income level, independent of insurance coverage, may also determine if a patient receives surgery. Both income and insurance type have been shown to be related to having bariatric surgery [1, 2, 26, 27], although the independent effects of these factors have not been tested.

Finally, we found that adherence to scheduled outpatient visits and the planning for problems that interfered with goals as a weight control strategy predicted having bariatric surgery. Previous research has shown that patients with higher adherence rates to visits and behavior changes before surgery are more likely to lose weight after surgery [16]. In the current study, we found using chart review that 51 (17%) of the 295 survey participants who did not have surgery did not complete the preparation course, lab work, or required exams. Finally, although the Longitudinal Assessment of Bariatric Surgery (LABS-2) found that certain behavioral practices after surgery around eating were predictors of weight loss [39], ours is the first study to show behavioral strategies, like preplanning, may also be important for a patient's having surgery.

This study had some important limitations. One was the biased nature of the study sample. These were all patients who were near the end of a preparation course for surgery, and thus, they were predisposed to have surgery. Our findings may have been different if we had surveyed patients when they were referred for surgery before beginning the course. In addition, we had a low survey response rate of 42.4% further limiting our generalizability. Even though our patients had insurance coverage, not everyone had the same coverage. When considering barriers to surgery, the study did not capture or assess out-of-pocket costs such as high deductibles and co-pays for pre-surgical exams and lab assessments. Finally, even though this healthcare system included 23 bariatric surgeons across 9 practices, our findings may not apply to other bariatric practices and thus should be replicated more systematically in other settings.

Conclusion

Overall, these findings indicated that there may be important considerations for shared decision-making [40] between patients and providers regarding the decision to undergo surgery for weight loss. Disparities in who does not receive bariatric surgery, primarily older, male patients with high comorbidity burdens, are important to consider as researchers, policy makers, and medical professionals work to improve access to bariatric surgery. Practices such as 5–10% TWL before surgery and selection of patients with safer operative risk profiles (younger with lower comorbidity burden) may inadvertently contribute to under-utilization of bariatric surgery among some demographic subpopulations [34] who could most benefit from this intervention.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent The Kaiser Permanente Southern California institutional review board (IRB) for human subjects approved all study procedures and waived the requirement for signed informed consent; however, all participants provided informed consent for the study during the phone and email/web-based recruitment for the study. The IRB also approved using the EMR to determine eligibility without obtaining consent.

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