New Onset Mental Health Diagnosis and Emergent Service Utilization Associated With Bariatric Surgery

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Abstract

Objective: The objective of this study was to investigate potential associations between bariatric surgery and new onset mental health diagnoses and emergent psychiatric care utilization.

Methods: This was an observational retrospective cohort study. Patients without a history of mental health diagnoses who underwent bariatric surgery between 2010-2016 were matched to patients who were eligible for but did not undergo bariatric surgery on demographic, body mass index (BMI), and comorbidity burden at baseline (date of surgery for cases and matching date for controls). Outcomes of new onset mental health diagnoses after baseline and emergent care utilization were measured in 2-year increments between baseline (ranged from 2010 to 2016) until the end of follow-up (December 31, 2021) to assess changes in risk over time.

Results: The surgical group had lower risk of a new onset mental health diagnosis in the first 2 years (hazard ratio [HR]: 0.82, 95% CI, 0.76–0.88) and approximately 20% higher risk in years 4–8 of follow-up than the control group (years 4–6 HR: 1.22, 95% CI, 1.09–1.36; years 6–8 HR: 1.19, 95% CI, 1.03–1.39). However, emergent psychiatric service utilization did not differ between the groups during follow-up. Utilization was associated with a higher BMI (HR: 1.03, 95% CI, 1.02–1.04) and higher comorbidity burden (HR: 1.43, 95% CI, 1.37–1.49) at baseline.

Conclusions: Bariatric surgery may have a delayed impact on new onset mental health diagnoses, with surgical patients having higher risk of diagnoses than their nonsurgical counterparts 4–8 years following surgery. Despite these increases, there was no change in emergent psychiatric service utilization.

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The US continues to experience an increasing prevalence of obesity, approaching close to half of the population.[1] At the same time, there is an increasing prevalence of mental health conditions, and significant links between obesity and poor mental health continue to be identified.[2–5] Because bariatric surgery is the most effective long-term treatment for obesity and metabolic disorders,[6] psychiatric improvement is thought to follow as a consequence.[7] However, there is increasing evidence that patients often experience worsening psychiatric symptoms following bariatric surgery,[8–15] and there is a growing need for long-term data on the incidence of psychiatric conditions postsurgery.[16] For example, a multicenter study revealed increased all-cause emergency department visits and hospitalizations following surgery in patients with significant prior psychiatric history compared to those with no psychiatric history.[17] Psychiatric-focused emergent care utilization was not specifically studied. Case reports have described new-onset primary psychiatric illnesses postsurgery,[18] and analyses in other countries show increased utilization of psychiatric services in the years following surgery in both patients with and without prior psychiatric history[19,20] as well as increases in new diagnoses of primary psychiatric disorders in bariatric surgery patients when compared to nonsurgical patients.[20]

To our knowledge, there has not been a comparable analysis of psychiatric emergent care utilization or rate of new onset mental health diagnoses performed for bariatric surgery patients, compared to those patients eligible for surgery but who do not have surgery, in the US. These patients, despite the benefits of bariatric surgery, may continue to experience unfavorable outcomes specific to their mental health. Given the continued rise in prevalence of obesity in the US, the potential for increased psychiatric conditions in patients who have bariatric surgery is an important concern for health systems. This area of research remains important

Clinical Points

- With the ongoing obesity epidemic and evolving treatment options, it is important to understand how therapeutic interventions can impact short- and long-term mental health outcomes.
- For patients with a history of bariatric surgery, it is important to recognize the increased risk of developing a psychiatric condition beginning postoperative year 4 and implement screening along with timely clinical intervention 3–5 years following surgery.

even with the rise in use of glucagon-like peptide-1 (GLP-1) medications to treat obesity. Although their use may initially decrease the utilization of bariatric surgery, these medications are not as effective as surgery for cardiovascular outcomes and mortality[21] and may have serious complications,[22] and patients regain most of their weight after discontinuation.[23] Less than 15% of bariatric patients regain most of their weight after 5 years, and major complications from current operations are rare.[24] In addition, many health insurers are not covering the cost of GLP-1 medications,[25] while bariatric surgery is more often covered,[26] making it likely that bariatric surgery will remain a viable choice for the treatment of obesity.

Our study is designed to investigate potential associations between bariatric surgery and the rate of new onset mental health diagnoses as well as emergent psychiatric care utilization following surgery. We employed a rigorous retrospective observational study design to compare differences between postoperative bariatric patients and their nonsurgical counterparts.

METHODS

Setting

The study took place in a large integrated health system in Southern California that includes insurance coverage, internal hospitals and medical offices, a medical group of over 7,000 physicians, and an extensive EPIC-based electronic health record (EHR). The system provides insurance coverage for all bariatric surgery operations. In addition to the general eligibility criteria for surgery used throughout the US,[27] all patients in this health system were required to complete the following: (1) all classes in a 12-week preparation course, (2) surgery within 12 months of their surgical consult, (3) extensive laboratory testing, (4) psychiatric and physical exams, and (5) consultation with a bariatric surgeon before they could have surgery. Patients could not be current smokers or users of drugs and alcohol. Additional recommendations were also made during the preparatory class before they were scheduled for surgery: (1) at least 5% total weight loss (%TWL) during their participation in classes and (2) control of medical (ie, diabetes with hemoglobin A1c < 7%) and psychiatric (ie, treated bipolar disorder) comorbidities as evidenced in the required physical and psychiatric exams. These were only recommendations, and surgeons and patients could make decisions about having surgery based on other information.[28]

Following surgery, patients are monitored by registered nurse care managers for up to 5 years as per guidelines from the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program,[29] which includes nutritional counseling and laboratory monitoring, management of chronic conditions such as type 2 diabetes, and ongoing assessment of psychiatric conditions such as depression. If necessary, patients are provided specialty care such as endocrinology or psychiatry. Kaiser Permanente Southern California Institutional Review Board reviewed and approved this study and waived informed consent.

Study Design and Data Sources

The study is a retrospective observational cohort design. Data came from the system's bariatric surgery registry and EHR. The registry is an active database of patients who had any bariatric operation since 2009 and was the primary source to identify the surgical group.[30] All other pertinent information came from EHR data. The study period was between 2010 and 2021, resulting in a maximum follow-up time of 12 years.

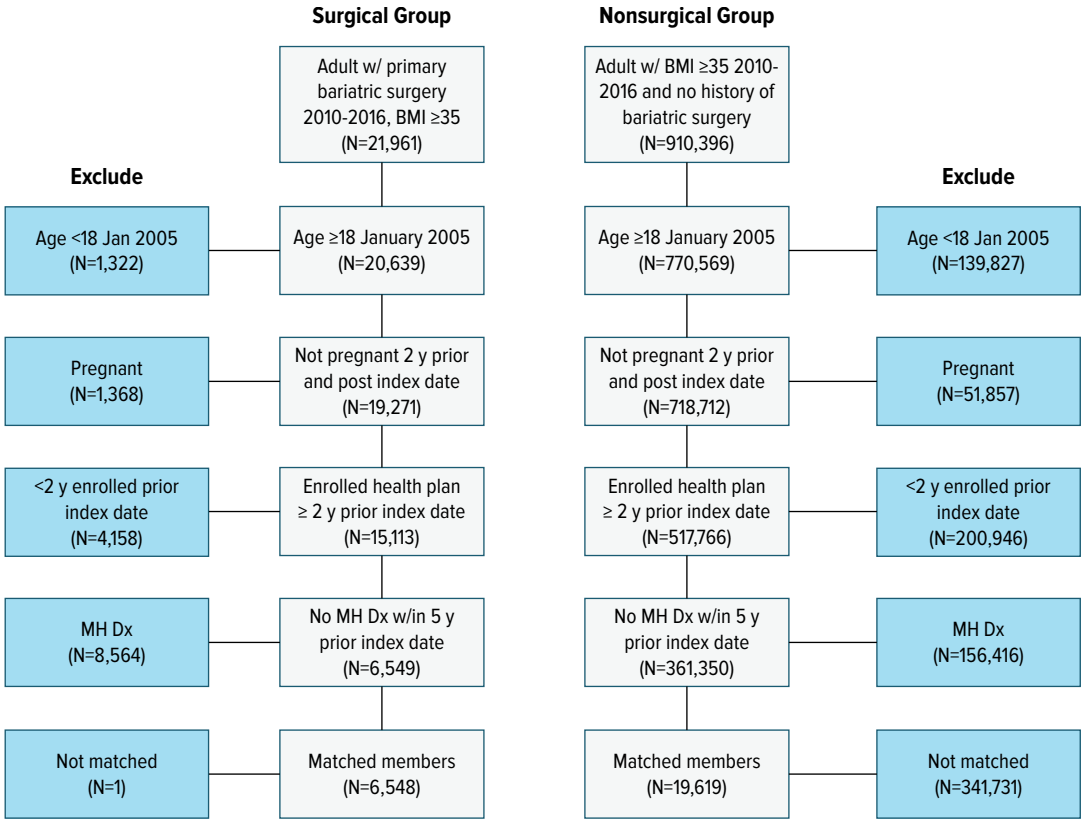
Participants

The study included patients with BMI ≥35 and at least 18 years of age in 2005 to assure that the earliest cohort of patients (2010) were of adult age (Figure 1). They had to also be free of any mental health diagnosis, including eating and substance use disorders, within 5 years prior to baseline (date of surgery for cases and matching date for controls). We excluded patients who were pregnant 2 years prior to baseline or any time during follow-up. Patients who were with the health system for less than 2 years before baseline were also excluded to minimize the chance of missing pertinent health history data. The surgical group consisted of patients who had an initial gastric bypass or gastric sleeve bariatric operation any time between 2010 and 2016. Nonsurgical group patients included those who did not have any bariatric procedure historically or during the study period.

Outcomes

The primary outcome was new onset mental health diagnosis with time at risk beginning at baseline and ending at the first mental health diagnosis or when the first of one of the following events occurred: end of study follow-up (December 31, 2021), death, or disenrollment

Figure 1.
Study Flowchart



Abbreviations: BMI = body mass index, MH Dx = mental health diagnosis.

from health system. New onset mental health diagnoses were defined by *ICD-9* and *-10* codes for the following disorders: anxiety, depression, other mood disorders, psychotic, trauma and stressor-related, eating disorders, and substance use. We did not include neurocognitive disorders or delirium. The second outcome was emergent mental health utilization beginning from baseline to the end of follow-up. Emergent events were defined as mental health consultations in the emergency department, inpatient admissions with a mental health diagnosis, and urgent psychiatry office visits.

Covariates

The following baseline covariates were all obtained from the EHR and included in the statistical models: gender, age, race, BMI, and Elixhauser comorbidity index. Data were obtained for the 2 years before baseline. Type 2 diabetes was included in the Elixhauser comorbidity index and was not included as a separate covariate in the models.

Analyses

Matching. Patients from the surgical group were matched to individuals in the nonsurgical group at a 1:3 ratio without replacement. The matching characteristics were BMI (±2.5 kg/m^2), age (±5 years), gender, race, and diabetes diagnosis (yes/no) at any time within the 2 years prior to baseline. Baseline index date of the surgical patients was their surgery date. To obtain the baseline index date for the nonsurgical patients, we first identified patients who did not have a history of bariatric operation or any operation during the study period. Then, we extracted their health encounters between 2010 and 2016 when they had a BMI ≥35 kg/m^2 and did not have a mental health diagnosis within 5 years before their encounter. All eligible encounters were possible for matching, and the encounter event that was matched became the index date of the nonsurgical patient. The reason for this approach was because BMI ≥35 kg/m^2 is a criterion for bariatric surgery. Given that BMI fluctuates, a patient in the nonsurgical group may be a better match for a surgical patient later in the study period. Defaulting to the first encounter as the baseline index date would have captured nonsurgical patients when they were younger with possibly fewer comorbidities.

Of the 6,549 patients in the surgical group, 6,534 (99.8%) had 3 matches, 14 (0.2%) had at least 1, and 1 patient (0.02%) had none. We included all

Table 1.

Patient Characteristics Before and After Matching Bariatric Surgery Patients to Nonsurgical Controls[a]

	Before matching			After matching		
	Control	Surgery	SMD	Control	Surgery	SMD
N	361,350	6,549		19,619	6,548	
Age, mean (SD), y	50.4 (13.54)	46.8 (10.18)	−0.30	46.8 (10.17)	46.8 (10.18)	0.00
Age group, n (%)						
18–30 years	22,500 (6.2)	275 (4.2)	-0.09	807 (4.1)	275 (4.2)	0.00
31–64 years	279,876 (77.5)	5,979 (91.3)	0.39	17,926 (91.4)	5,978 (91.3)	0.00
≥65 years	58,974 (16.3)	295 (4.5)	-0.39	886 (4.5)	295 (4.5)	0.00
Female, n (%)	184,210 (51.0)	4,669 (71.3)	0.43	13,993 (71.3)	4,668 (71.3)	0.00
Race, n (%)						
Asian	11,783 (3.3)	117 (1.8)	−0.09	346 (1.8)	117 (1.8)	0.00
Black	51,964 (14.4)	1,495 (22.8)	0.22	4,481 (22.8)	1,495 (22.8)	0.00
Hispanic	153,093 (42.4)	2,725 (41.6)	−0.02	8,169 (41.6)	2,725 (41.6)	0.00
White	130,121 (36.0)	2072 (31.6)	−0.09	6,212 (31.7)	2072 (31.6)	0.00
Other	7,155 (2.0)	103 (1.6)	−0.03	307 (1.6)	103 (1.6)	0.00
Unknown	7,234 (2.0)	37 (0.6)	−0.13	104 (0.5)	36 (0.5)	0.00
BMI, mean (SD), kg/m^2	38.9 (4.61)	44.8 (6.72)	1.03	44.8 (6.63)	44.8 (6.72)	0.01
BMI group, n (%)						
35–39 kg/m^2	261,667 (72.4)	1,675 (25.6)	−1.06	5,025 (25.6)	1,675 (25.6)	0.00
40–45 kg/m^2	70,943 (19.6)	2,570 (39.2)	0.44	7,706 (39.3)	2,570 (39.2)	0.00
46–49 kg/m^2	16,127 (4.5)	1,065 (16.3)	0.39	3,193 (16.3)	1,065 (16.3)	0.00
50–55 kg/m^2	8,958 (2.5)	801 (12.2)	0.38	2,417 (12.3)	801 (12.2)	0.00
56–59 kg/m^2	2006 (0.6)	226 (3.5)	0.21	676 (3.4)	226 (3.5)	0.00
≥60 kg/m^2	1,649 (0.5)	212 (3.2)	0.21	602 (3.1)	211 (3.2)	0.01
Comorbidity burden (number of conditions), mean (SD)	1.8 (1.8)	2.8 (1.5)	0.63	2.6 (1.8)	2.8 (1.5)	0.17

[a]Standard mean differences (SMDs) are used to determine significance, and SMDs <0.20 are considered small and not clinically meaningful.
Abbreviation: BMI = body mass index.

6,548 surgical group patients who had at least 1 match in the analytical sample, in addition to the 19,619 matched patients from the nonsurgical group. To ensure that the 2 groups were comparable, we examined their standardized mean differences (SMDs) before and after matching and utilized Cohen difference <0.2 as the threshold for determining a small effect (Table 1). The demographic distributions of the study population were representative of the adult membership of the health system.[31]

Statistical plan. We inspected the Kaplan-Meier cumulative incidence curves to visualize the probability of having a new onset mental health diagnosis over time between the 2 study groups (Figure 2). The curves crossed, suggesting violation of Cox regression proportionality assumption. This was further corroborated with a log-log graph and the statistically significant interaction effect between time and surgical group. To address this issue, we adopted piecewise Cox regression to model the time-varying hazard ratios (HRs) of having a new onset mental health diagnosis. The time intervals were divided into increments of 2 years to assess how the risk changed over time.

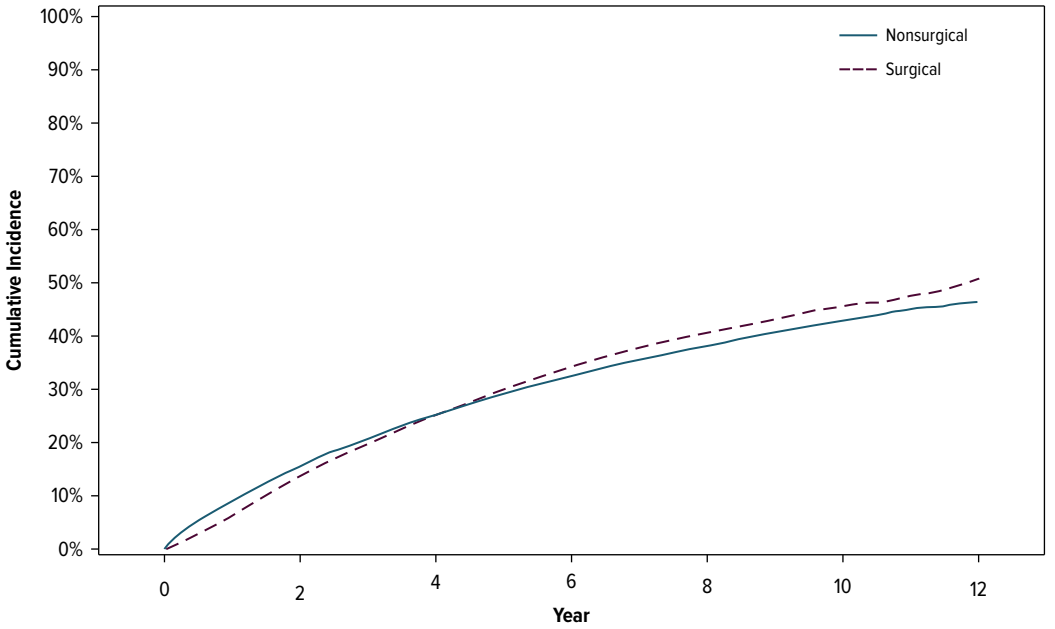
We also analyzed rates of emergent mental health care utilization in 2-year increments. Poisson regression via generalized estimating equation with robust standard errors was appropriate to analyze the incident rate ratios (IRRs) between the 2 groups and to account for the repeated data structure of the patients.[32,33] All analyses were conducted in SAS Enterprise Guide 8.3.

RESULTS

Table 1 displays the standardized differences between the 2 study groups before and after matching. Prior to matching, the 2 groups' attributes were noticeably different (SMD ≥0.2). The surgical group was predominately female, younger, and more likely diabetic and had higher BMI and comorbidity burden. After matching, the SMD <0.01, indicating comparability between the study groups. Differences in the comorbidity burden, which was not a matching characteristic, improved from SMD = 0.63 to SMD = 0.17 after matching.

On average, patients of the matched cohort were 47 years old and had a BMI and comorbidity burden of 45 kg/m^2 and 2.6 conditions, respectively. Women made 71% of the sample. Hispanic (42%), White (32%), and Black (23%) represented the largest race groups in the sample. The average length of follow-up was 5.0 years. Overall, 31% of the matched cohort had a new onset mental health diagnosis during follow-up, including 35% surgical and 31% nonsurgical group patients. Three percent of the total cohort were censored due to death,

Figure 2.
Kaplan-Meier Cumulative Incidence of New Onset Mental Health Diagnosis



No. at risk							
Nonsurgical	19619	14181	11100	7601	4126	1792	51
Surgical	6548	5049	3908	2832	1770	859	12
Cumulative incidence (%)							
Nonsurgical	0%	15.5 (15.0-16.1)	25.3 (24.7-26.0)	32.6 (31.8-33.3)	38.3 (37.5-39.1)	42.9 (41.9-43.8)	46.3 (45.0-47.6)
Surgical	0%	13.7 (12.8-14.5)	25.1 (24.0-26.3)	34.2 (32.9-35.4)	40.9 (39.5-42.3)	45.6 (44.1-47.2)	50.4 (47.1-53.5)

27% because of disenrollment from the health system, and 38% because the study ended.

Outcome 1: New Onset Mental Health Diagnosis

Table 2 shows the adjusted HRs of new onset mental health diagnosis among the 2 study groups. Adjusting for age, race, sex, comorbidity burden, and BMI at baseline, the risk of having a new onset mental health diagnosis in the first 2 years after baseline was 18.0% lower (HR: 0.82, 95% CI, 0.76–0.88) for surgical patients compared to nonsurgical patients. However, during follow-up years 4–6, surgical patients had 22% greater risk than control patients (HR: 1.22, 95% CI, 1.09–1.36) and 19% greater risk in years 6–8 (HR: 1.19, 95% CI, 1.03–1.39). The risk of having a new onset mental health diagnosis was not significantly different between the 2 study groups between years 2–4 (HR: 1.09, 95% CI, 1.0–1.20).

We also found that female sex (HR: 1.49, 95% CI, 1.42–1.57) and having a higher comorbidity burden (HR: 1.13, 95% CI, 1.12–1.15) were associated with greater risk of having a new onset mental health diagnosis. Compared to White patients, Asian (HR: 0.61, 95% CI, 0.51–0.74) and Black (HR: 0.92, 95% CI, 0.87–0.97) patients had lower risk of having a new onset mental health diagnosis. Being older was also associated with lower risk (HR: 0.979, 95% CI, 0.977–0.981) of developing a new onset mental health diagnosis.

Outcome 2: Mental Health–Related Emergent Utilization

Table 3 shows the adjusted IRRs for emergent mental-health utilization among the 2 study groups. Compared to the first 2 years postsurgery, subsequent follow-up years had higher utilization rates. However, there were no differences between patients who had surgery and the comparison control patients at any time during follow-up. There were several covariates related to emergent mental-health–related utilization. This included having a higher comorbidity burden (IRR: 1.43, 95% CI, 1.37–1.49) and higher BMI (IRR: 1.03, 95% CI, 1.02–1.04). Compared to White patients, Asian patients had lower emergent mental health–related utilization (IRR: 0.60, 95% CI, 0.38–0.95).

DISCUSSION

Between follow-up years 4–8, the risk of having a new onset mental health diagnosis was significantly higher for

Table 2.

Adjusted Regression Results for Factors Related to New Onset Mental Health Diagnoses Following Bariatric Surgery Comparing Those Who Had Surgery and Those Who Did Not (Control)

Parameter	New MH diagnosis adjusted hazard ratio (95% CI)
Surgery vs control by follow-up year	
0–2 Years (referent is control group)	0.82 (0.76–0.88)*
2–4 Years	1.09 (1.0–1.20)
4–6 Years	1.22 (1.09–1.36)*
6–8 Years	1.19 (1.03–1.39)*
8–10 Years	1.03 (0.82–1.28)
≥10 Years	0.99 (0.63–1.56)
Age (years)	0.979 (0.977–0.981)*
Sex	
Male	Referent
Female	1.49 (1.42–1.57)*
Race	
White	Referent
Asian	0.61 (0.51–0.74)*
Black	0.92 (0.87–0.97)*
Hispanic	0.98 (0.93–1.03)
Other	0.83 (0.69–1.0)
Unknown	0.74 (0.49–1.14)
Comorbidity burden	1.13 (1.12–1.15)*
Body mass index (kg/m^2)	0.999 (0.995–1.00)

*Statistically significant α < .05.
Abbreviation: MH = mental health.

Table 3.

Adjusted Regression Results for Factors Related to Emergent Mental Health-Related Utilization Following Bariatric Surgery Comparing Those Who Had Surgery and Those Who Did Not (Control)

Parameter	Emergent MH utilization adjusted incident rate ratio (95% CI)
Follow-up year	
0–2 Years	Referent
2–4 Years	1.25 (1.03–1.50)*
4–6 Years	1.29 (1.06–1.58)*
6–8 Years	1.67 (1.34–2.08)*
8–10 Years	1.56 (1.20–2.03)*
≥10 Years	2.24 (1.58–3.15)*
Surgery group (referent is control group)	
Control	Referent
Surgery	0.83 (0.61–1.14)
Surgery group × follow-up year	
2–4 Years	1.29 (0.88–1.91)
4–6 Years	1.17 (0.79–1.74)
6–8 Years	1.29 (0.85–1.96)
8–10 Years	1.31 (0.81–2.14)
≥10 Years	1.12 (0.60–2.10)
Age (years)	0.99 (0.985–1.0)
Sex	
Male	Referent
Female	0.92 (0.77–1.09)
Race	
White	Referent
Asian	0.60 (0.38–0.95)*
Black	1.04 (0.85–1.28)
Hispanic	0.98 (0.81–1.18)
Other	1.12 (0.40–3.11)
Unknown	0.33 (0.08–1.29)
Comorbidity burden	1.43 (1.37–1.49)*
Body mass index (kg/m^2)	1.03 (1.02–1.04)*

*Statistically significant α < .05.
Abbreviation: MH = mental health.

individuals who had bariatric surgery compared to individuals who did not have surgery. It is difficult to compare our results to other studies in the literature, given there are few studies of new onset diagnoses of mental health conditions at the population level over such a long period of follow-up. One study outside the US also found that increases in new onset diagnoses of primary psychiatric disorders in bariatric surgery patients when compared to nonsurgical patients.[20] The only comparable study in the US was a recent cohort study that compared bariatric surgery patients to nonsurgical patients with obesity, which found a higher relative risk among bariatric surgery patients for suicide attempts which is related to psychiatric conditions. However, the absolute risk remained low, and further work was needed to clarify why the risk of suicide following bariatric surgery was higher.[34] Our study further supports that undergoing bariatric surgery may add additional risk for new onset mental health conditions following surgery.

Unlike the 2 studies outside the US that found increased utilization of psychiatric services in the years following surgery in both patients with and without prior psychiatric history,[19,20] we found no differences between groups up to 12 years following surgery. It is not clear why there were differences between our study and these 2 publications. One main difference is that our care system is specifically designed to provide longer-term follow-up for bariatric patients, which focuses on preventing the use of high cost services in inpatient and emergency department settings.[28,29] This difference from previous studies might also be due to our ability to further adjust for patient characteristics in our analysis to ensure that we had comparable groups. Our matching process was effective as evidenced by small, standardized differences in our covariates between groups (see Table 1).

In addition to these main outcomes, we also found that a higher comorbidity burden and BMI at the time of surgery were associated with higher rates of mental health–related emergent care utilization. It is unclear whether this is related to obesity or bariatric surgery and could be due to changes over time, increases in age, and

other factors. Previous studies agree that relationships between psychiatric destabilization and other potential risk factors remain to be further elucidated.[16,17,35]

There are several limitations that should be considered when interpreting the findings of this study. One of the most important is that this is a retrospective observational study in which patients were not randomly assigned to have surgery. Thus, we would not be able to say conclusively that bariatric surgery caused the increases in new onset mental health diagnoses we report. To mitigate this limitation, we used a doubly robust method of matching control and surgery patients in our design and then included confounding factors such as comorbidity burden in our statistical models. Another limitation is that we cannot be sure that we were able to determine the full history of mental health conditions before surgery as there may have been conditions that were not noted in the EHR. In particular, we are only able to make conclusions about new onset of diagnosed mental health conditions. We cannot say these are incident cases, nor can we say anything about mental health conditions that were not diagnosed.

In addition, there are patient characteristics we did not measure that could impact the differences. Results can also be due to potential unidentified maladaptive patterns of thinking and coping (such as binge eating) common to the bariatric population which may serve as a psychological predisposing factor to developing a mental health disorder or require emergency mental health services over time.[36,37] People who undergo bariatric surgery are more susceptible to certain nutritional deficiencies, including vitamin D, and require dietary modifications as part of routine postoperative care. We were not able to study adherence to dietary modifications or conduct laboratory studies suggestive of nutritional deficiencies. Theoretically, one could be more susceptible to depression with deficiencies in vitamin D. Future studies may be able to elucidate the potential relationship between increased risk of mental health diagnosis following bariatric surgery and nutritional deficiencies.[38,39]

Finally, our patients were cared for by an extensive network of physicians and support staff before and after surgery. Our findings may not generalize to patients having surgery in community settings without extensive preparation and follow-up.

CONCLUSION

Our work expands upon previous studies in that we identified potential time periods after surgery when mental health risk is greatest and intervention may be most needed. For example, we may potentially mitigate negative mental health outcomes by considering screening, follow-up, and intervention efforts after the first 2 postoperative years, especially by the fourth postoperative year. It is possible that underlying factors related to mental health outcomes, such as improvements in comorbidity burden, quality of life, and functional status, occur in the first 1–3 years following surgery, but with longer follow-up (5–10 years) there is evidence that adverse consequences such as addiction, lasting body dysmorphia, and loss of social support networks related to eating may develop,[15,40] undermining the immediate benefits of surgery for mental health outcomes.

Future research in bariatric surgery is needed to identify the influence of support networks, personality characteristics, lasting body dysmorphia, social and nonmedical needs, and coping strategies on mental health outcomes. This remains an important area of study even though GLP-1s are on the rise. There are limitations in coverage and still little known about the long-term effectiveness and safety of these medications, unlike bariatric surgery, which has almost 20 years of study.

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