Incidence and Determinants of Mental Health Service Use After Bariatric Surgery

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IMPORTANCE Obesity is associated with an increased prevalence of psychiatric disorders. The association of bariatric surgery with mental health outcomes is poorly understood.

OBJECTIVE To investigate the association of bariatric surgery with the incidence of outpatient, emergency department (ED), and inpatient mental health service use.

DESIGN, SETTING, AND PARTICIPANTS This statewide, mirror-image, longitudinal cohort study used data from Western Australian Department of Health Data Linkage Branch records from all patients undergoing index (ie, first) bariatric surgery in Western Australia over a 10-year period (January 2007-December 2016), with mean (SD) follow-up periods of 10.2 (2.9) years before and 5.2 (2.9) years after index bariatric surgery. The data analysis was performed between November 2018 and March 2019.

EXPOSURES Index bariatric surgery.

MAIN OUTCOMES AND MEASURES The incidence and predictors for mental health presentations, deliberate self-harm, and suicide in association with the timing of bariatric surgery.

RESULTS A total of 24,766 patients underwent index bariatric surgery; of these, the mean (SD) age was 42.5 (11.7) years and 19,144 (77.3%) were women. Use of at least 1 mental health service occurred in 3,976 patients (16.1%), with 1,401 patients (35.2%) presenting only before surgery, 1,025 (25.8%) presenting before and after surgery, and 1,550 patients (39.0%) presenting only after surgery. There was an increase in psychiatric illness presentations after bariatric surgery (outpatient clinic attendance: incidence rate ratio [IRR], 2.3; 95% CI, 2.3-2.4; ED attendance: IRR, 3.0; 95% CI, 2.8-3.2; psychiatric hospitalization: IRR, 3.0; 95% CI, 2.8-3.1). There was also a 5-fold increase in deliberate self-harm presentations to an ED after surgery (IRR, 4.7; 95% CI, 3.8-5.7), with 25 of 261 postoperatives deaths (9.6%) due to suicide. Complications after bariatric surgery requiring further surgical intervention and a history of mental health service provision before surgery were the most important associations with subsequent mental health presentations after surgery. Deliberate self-harm and mental and behavioral disorders due to psychoactive substance use before bariatric surgery were the main associations with subsequent deliberate self-harm or suicide after surgery.

CONCLUSIONS AND RELEVANCE We observed an increase in mental health service presentations after bariatric surgery, particularly among those who had prior psychiatric illnesses or developed surgical complications requiring further surgery. These findings caution the hypothesis that weight reduction by bariatric surgery will improve mental health in patients with obesity.

Published online September 25, 2019.

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The association between excess weight gain and mental health is complex and likely involves many genetic, hormonal, social, and environmental factors. Obesity has been causally linked to body dissatisfaction, low self-esteem, and depression; conversely, psychiatric conditions are associated with the onset of weight gain.\(^{1-3}\) Individuals with obesity are often stigmatized, facing social exclusion and discrimination,\(^4\) while the co-diagnoses of obesity and mental health appear to propagate physical illness.\(^5\) Given that obesity (31.3%) and psychiatric conditions (20.1%) are prevalent in Australia and many other countries,\(^6\) an effective weight loss strategy could affect these 2 major health issues for millions of people.

Bariatric surgery, first conceived in the 1950s, has become an increasingly common procedure in the last 2 decades, with a growing number of studies confirming its safety and long-term effectiveness in reducing body weight.\(^7-9\) However, several recent studies have highlighted a concern that bariatric surgery may exacerbate psychiatric conditions.\(^3,10-12\) Especially deliberate self-harm (DSH) and suicide.\(^13\) In response to this, major professional bariatric societies currently recommend that potential surgical candidates should have either no active severe psychopathology or drug dependency problems and/or have undergone psychological assessment before surgery.\(^14,17\) However, how bariatric surgery is associated with broader mental health outcomes remains poorly understood.

We hypothesized that bariatric surgery may exacerbate co-morbid psychiatric conditions, resulting in an increased requirement for mental health services after surgery, including for those without prior psychiatric illnesses. This study assessed the incidence and risk factors for mental health service use after bariatric surgery, including psychiatric outpatient clinic (OPC) care and emergency department (ED) presentation or hospitalization, stratified by different types of psychiatric conditions.

**Methods**

**Study Design and Setting**

This was a population-based, retrospective, longitudinal, mirror-image cohort study including all patients who underwent index (ie, first) elective bariatric surgery in private and public health care institutions during a 10-year period between 2007 and 2016 in Western Australia. The start point of the studied period was chosen based on the rapid increase in bariatric procedures from 24.4 bariatric surgical procedures per 100,000 person-years in 2004 to 94.4 bariatric surgical procedures per 100,000 person-years by 2007.\(^18\) The longitudinal, mirror-image design allowed for an incidence comparison between mental health use before and after bariatric surgery while minimizing the confounding association of important patient characteristics, such as sex and medical comorbidities. Comorbid data were collected from January 2002, guaranteeing a minimum 5-year preoperative observation period, with a final censor date of June 1, 2017, unless the patients died earlier, ensuring a minimum postoperative follow-up observation period of 5 months for all study patients after their index bariatric surgery. Western Australia had a population of 2.39 million in 2011, comprising 10.4% of the total Australian population with an emigration rate of less than 1.2%.\(^19\)

**Data Sources**

The Western Australian Department of Health Data Linkage Branch systematically links and updates the administrative private and public health care data for the entire state of Western Australia by merging data from 8 independent statewide data registries, including the birth records, private and public hospitalization data, cancer registry, ED presentations, public OPC and inpatient psychiatric services data, death registry, midwives’ notifications, and the Western Australian electoral roll.\(^20,21\) In this study, patients who had their index bariatric surgery in Western Australia were first identified from the private and public hospitalization data set. Their corresponding mental health data were obtained through the ED presentation data set and the inpatient and public OPC mental health services data sets. The medical comorbidities and survival data were obtained from the private and public hospitalization data set and death registry, respectively. The accuracy of this process has previously been validated,\(^9,16\) with successful completion of multiple population-based studies.\(^9,16\) The incidence of suicide in the study cohort was compared with the general population in Western Australia using data from the Western Australia Mental Health Commission.\(^22\) Ethics approval, including a waiver of consent, was obtained from the authors’ home institution, St John of God Subiaco Hospital, and the Western Australian Department of Health Human Research ethics committees before the deidentified data, with diagnoses, procedures, and causes of death coded according to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10)* system, was released to the study investigators.

**Participants**

In this study, only patients who had their index bariatric surgery in Western Australia during the study period were included. The presence or absence and also the incidence of men-
Variables and Outcomes
The primary outcome was the incidence of mental health service use, including psychiatric OPC attendance, ED presentations with a psychiatric diagnosis, and inpatient hospitalizations because of a psychiatric disorder before and after each index bariatric surgery. Secondary outcomes were the incidence of patients presenting to the ED for suicidal ideation or DSH and incidence of completed suicide after bariatric surgery.

Statistical Analysis
The incidence of psychiatric OPC or ED presentations and hospitalizations was reported as the number of events per 10,000 patient years. The difference in incidence rates of these psychiatric presentations before and after surgery was reported as incidence rate ratios (IRRs) and its statistical significance was analyzed using the Wilcoxon signed rank test. The mirror-image design was used to minimize confounding, and IRR was used to account for the variable follow-up periods before and after surgery for each patient. Because suicide was a rare occurrence, suicide rates were reported in number of events per 100,000 person-years with subsequent sex standardization.

A multivariable logistic regression was used to assess the determinants of postoperative mental health service use, DSH, and suicide after bariatric surgery. These multivariate models initially included biologically plausible risk factors for mental health service use in addition to the calendar year of the index procedure and follow-up duration. Covariates with a P value of more than .25 were then removed in a stepwise fashion, starting with covariates with the largest P value, to generate a parsimony model to improve the precision of the results. The strength of the predictors was reflected by the magnitude of the adjusted odds ratio (aOR) for ordinal dependent variables and a linear regression for continuous dependent variables. Imputation was not used to replace missing data. All statistical tests were 2-tailed and performed using SPSS, version 23.0 (IBM Corp). Statistical significance was set at P < .05.

Results
Patient Characteristics
Of the 26,787 patients who underwent any bariatric surgical procedure in Western Australia between 2007 and 2016, 24,766 (92.5%) had their index bariatric surgery during the study period (Figure). The mean (SD) age of patients at the time of their index bariatric surgery was 42.5 (11.7) years and 19,144 (77.3%) were women. Most of the index bariatric surgery was performed in a private metropolitan hospital (22,515 [90.9%]); only 1,886 bariatric procedures (7.6%) were performed in a rural hospital. The total follow-up time for the whole cohort was 252,363.3 patient-years before surgery (mean [SD] 10.2 [2.9] years per patient) and 128,741.8 patient-years after surgery (mean [SD] 5.2 [2.9] years per patient). A total of 5,001 study patients (20.2%) had 1 or more subsequent bariatric procedures after their index bariatric surgery during the study period.

Overview of Mental Health Service Use
During the study period, 3,976 patients (16.1%) presented on at least 1 occasion to a psychiatric service; of these, 1,401 (35.2%) attended such services only in the preoperative period, 1,025 (25.8%) attended psychiatric services before and after index bariatric surgery, and 1,550 (6.9%) of all patients who did not have any documented psychiatric illness before surgery first...
attended a psychiatric service only after surgery. Overall, approximately 2575 patients (10%) required at least 1 episode of mental health services after their surgery. Table 1 outlines the number of patients who used different types of mental health services either before, after, or before and after surgery. There was a significant increase in the number of patients who underwent bariatric surgery who attended, one form or another, a mental health service after surgery compared with before surgery (39% vs 35.2%; Wilcoxon signed rank test: P = .006).

### Incidence of Different Mental Health Conditions Requiring Mental Health Services

We observed an increase in the incidence of mental health service use across all 3 major types of mental health services and for all psychiatric conditions (IRR ranged between 1.3 and 7.7). Table 2 outlines the number of patients with different types of psychiatric conditions and the associated incidence of mental health use before and after their index bariatric surgery and then stratifies them by the 3 major types of mental health service (psychiatric OPC, ED attendance, or psychiatric inpatient hospitalization). To minimize confounding from changes in practice, regression toward the mean, confounding by indication, or bias from aging, we conducted 2 sensitivity analyses. Restricting our analysis to either the central years of 2009 and 2010 or to patients with a maximum 24-month follow-up (eTable 3 in the Supplement) did not change the association between bariatric surgery and increased postoperative mental health service use.

There was an increasing trend of outpatient mental health services use after the first bariatric surgery for those who did not have any psychiatric health history in recent years (7.9-16.0 new patients per 1000 patient-years), whereas the incidence of psychiatric ED presentations and hospitalizations appeared to be relatively stable across the 10-year period (eFigure in the Supplement).

### Determinants of Requiring Mental Health Services Before Bariatric Surgery in Those Without Any Prior Mental Health Condition

Table 3 outlines the factors for patients who required different types of mental health services for the first time after bariatric surgery. A prior preoperative presentation to one type of psychiatric service was the strongest predictor for requiring other types of psychiatric services after surgery (aOR ranged between 1.62 and 3.73). Apart from young age, surgical complications after the index bariatric surgery requiring further surgical interventions was the only factor consistently associated with an increased risk of requiring, in one form or another, mental health services after surgery (aOR ranged between 1.23 and 1.45). In a secondary analysis using a linear regression to assess the determinants associated with an increasing number of first-time psychiatric presentations after bariatric surgery, patient age, prior presentation to an alternative mental health service, and reoperation for bariatric complications were all significant risk factors for requiring more psychiatric services after the index bariatric surgery (eTable 4 in the Supplement).

### Determinants of Deliberate Self-harm, Suicidal Ideation, and Suicide After Bariatric Surgery

A total of 333 patients undergoing bariatric surgery presented to an ED with DSH or suicidal ideation after their index bariatric surgery, and the incidence rate of these psychiatric conditions was significantly higher after surgery compared with before surgery (IRR, 4.7; 95% CI, 3.8-5.7). Patients who were younger (aOR, 0.95 per year increment; 95% CI, 0.94-0.96), with a higher socioeconomic status (aOR, 1.06; 95% CI, 1.00-1.13), who had DSH or suicidal ideation, mental and behavioral disorders due to psychoactive substance use or mood disorders before their index bariatric surgery, and had a sleeve gastrectomy (aOR, 2.03; 95% CI, 1.00-4.11) or a bypass procedure (aOR, 3.62; 95% CI, 1.12-11.76) as their index bariatric procedure were significantly associated with an increased risk of DSH or suicidal ideation after their first bariatric surgery (Table 4).

Of 261 deaths recorded during the follow-up period after surgery, 25 patients (9.6%) committed suicide (95% CI, 6.0%-13.2%). The suicide rate after index bariatric surgery was 19.4 deaths per 100 000 patient-years. Women accounted for 15 suicides (15.0 deaths per 100 000 patient-years) and men for 10 suicides (35.1 deaths per 100 000 patient-years). The overall, male, and female standardized suicidal rates of the cohort were higher than the corresponding suicidal rates of the general population (13.5 per 100 000 person years), male (19.8 per 100 000 person years), and female (7.2 per 100 000 person...
years) suicide rates in Western Australia, respectively. Hospitalization because of a DSH (aOR, 5.34; 95% CI, 1.22-23.34) and mental and behavioral disorders due to psychoactive substance use (aOR, 4.69; 95% CI, 1.03-21.30) before patients’ index bariatric surgery were the only 2 factors significantly associated with an increased risk of suicide after surgery (eTable 5 in the Supplement).

### Discussion

Although shown to be an effective method in achieving weight loss, controversy remains whether bariatric surgery may increase the risk of adverse mental health outcomes, including DSH. In this population-based statewide cohort study,
we found that 1 in 6 patients (16.7%) had used at least 1 episode of a mental health service during the study period, with approximately 1 in 10 (10%) of all patients doing so after their first bariatric surgery. Mental health service use across 3 major types of mental health provisions increased significantly, and this remained consistent across all major psychiatric conditions. Furthermore, ED presentations because of DSH or suicidal ideation were also significantly increased after index bariatric surgery, with the overall suicide rate accounting for 10% of all deaths among patients who underwent bariatric surgery. These findings have important implications and require further discussion.

Potentially, some Australian bariatric surgeons may not be completely aware of, or hesitant to follow, the available guidelines that exist regarding the perioperative assessment of, and recommendations for, patients with prior psychiatric illness, instead believing that any successful reduction in body weight may outweigh any possible mental health harms. Our findings question this latter belief and support the peer-reviewed guidelines published by the American Society of Metabolic and Bariatric Surgery surrounding careful patient selection. In most cases, it would be recommended that patients with an active or recent history of severe psychopathology, compulsive behaviors, DSH, suicidal ideation, or mental and behavioral disorders due to psychoactive substance use be excluded or have their bariatric surgery postponed until the active psychiatric issues have been treated with a period of mental health stability. It therefore remains incumbent on all health care clinicians to integrate and communicate an agreed multidisciplinary, perioperative plan in patients with complex psychiatric conditions that prioritizes the ready postoperative access to mental health services.

Psychiatric conditions requiring different forms of mental health services were not uncommon in this study, including those without any prior documented psychiatric illnesses (1550 of 22340 patients [6.9%]). An absence of well-documented psychiatric conditions before bariatric surgery...
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Table 4. Logistic Regression Showing Risk Factors for 333 Patients Who Underwent Bariatric Surgery Presenting to an ED With Suicidal Ideation or DSH After Their Index Bariatric Procedure Between 2007 and 2016

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Univariate OR (95% CI)</th>
<th>P Value</th>
<th>Multivariate OR (95% CI) b</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, per year</td>
<td>0.95 (0.94-0.96)</td>
<td>&lt;.001</td>
<td>0.95 (0.94-0.96)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sex, male</td>
<td>0.89 (0.68-1.17)</td>
<td>.40</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Private insurance</td>
<td>1.57 (1.21-2.03)</td>
<td>.001</td>
<td>1.46 (1.12-1.92)</td>
<td>.06</td>
</tr>
<tr>
<td>Charlson comorbidity index &gt;0</td>
<td>1.23 (0.93-1.64)</td>
<td>.15</td>
<td>1.35 (0.98-1.85)</td>
<td>.07</td>
</tr>
<tr>
<td>Index bariatric surgery undertaken at a rural hospital</td>
<td>1.09 (0.74-1.62)</td>
<td>.66</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>SEIFA LGA IRSD, per increasing decile d</td>
<td>1.05 (0.99-1.11)</td>
<td>.10</td>
<td>1.06 (1.00-1.13)</td>
<td>.04</td>
</tr>
<tr>
<td>Preoperative psychiatric history</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior ED presentation with DSH or suicidal ideation</td>
<td>14.58 (9.12-23.29)</td>
<td>&lt;.001</td>
<td>4.84 (2.74-8.54)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Prior hospitalization, DSH f</td>
<td>16.55 (11.63-23.54)</td>
<td>&lt;.001</td>
<td>2.42 (1.50-3.91)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Prior hospitalization, mental disorders due to psychotic substance use e</td>
<td>15.74 (10.58-23.42)</td>
<td>&lt;.001</td>
<td>2.75 (1.65-4.57)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Prior hospitalization, mood disorders e</td>
<td>12.88 (9.82-16.89)</td>
<td>&lt;.001</td>
<td>5.89 (4.07-8.50)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Surgical factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of operation, gastric band f</td>
<td>1.71 (0.79-3.67)</td>
<td>.17</td>
<td>1.58 (0.71-3.32)</td>
<td>.26</td>
</tr>
<tr>
<td>Type of operation, gastric sleeve f</td>
<td>1.64 (0.83-3.22)</td>
<td>.15</td>
<td>2.03 (1.00-4.11)</td>
<td>.05</td>
</tr>
<tr>
<td>Type of operation, gastric bypass f</td>
<td>2.82 (0.92-8.66)</td>
<td>.07</td>
<td>3.62 (1.12-11.76)</td>
<td>.03</td>
</tr>
<tr>
<td>Repeated surgery, obesity a</td>
<td>0.84 (0.39-1.80)</td>
<td>.65</td>
<td>0.68 (0.31-1.51)</td>
<td>.34</td>
</tr>
<tr>
<td>Repeated surgery, complications a</td>
<td>1.50 (1.12-2.03)</td>
<td>.09</td>
<td>1.30 (0.94-1.79)</td>
<td>.11</td>
</tr>
<tr>
<td>Repeated surgery, obesity and complications a</td>
<td>1.02 (0.69-1.52)</td>
<td>.91</td>
<td>0.77 (0.51-1.16)</td>
<td>.21</td>
</tr>
</tbody>
</table>

Abbreviations: DSH, deliberate self-harm; ED, emergency department; IRSD, Index of Relative Socio-Economic Disadvantage; LGA, local government area; NA, not applicable; OR, odds ratio; SEIFA, Socio-Economic Indexes for Areas.

a Index procedure is when the original bariatric surgery occurred between 2007 and 2016. Total cohort size = 24,766 patients who underwent bariatric surgery.

b Multivariate logistic regression adjusted for year of surgery and duration of follow-up.

c Excluded in stepwise backward elimination.

d The IRSD is a general socioeconomic index that summarizes a range of information about the economic and social conditions of people and households within an area. It includes only measures of relative disadvantage with lower deciles equating with increasing disadvantage.


Strengths and Limitations

The strengths in this study lie in the robust source of the data and the ability to consider multiple modes of mental health presentations in the analysis. The limitations in this study include the possibility that some of the patients may have had mild mental health conditions that were solely managed by their family physicians or private psychiatrists and were not captured by this study. Alternatively, increased service use may represent greater scrutiny and closer follow-up in the postoperative period. This study was also beholden to the specifics of large administrative databases not explicitly designed for individual studies. As such, the data set relies on diagnostic coding rather than a criterion standard mental health diagnostic instrument and is devoid of useful variables, such as height and weight, and subject to a change in the Australian bariatric procedural codes in July 2013. Caution also needs to be exercised when assessing the suicide data in isolation. The absence of a control group and the relatively low overall incidence of suicide have limited our ability to determine the true risk and all the potential risk factors. Finally, we acknowledge that although our study used a state-wide administrative database, it was not a nation-wide study and we further caution the generalization of our findings to alternative health care systems and regions.

does not therefore imply that these patients are not at risk of developing serious mental health conditions after surgery. Whether using a preoperative psychological assessment, as recommended by the current guidelines, can identify those at risk and improve their mental health outcomes, to our knowledge, remains scientifically unproven. Because surgical complications were associated with an increased incidence of mental health service use, mental health outcomes should thus be incorporated as one of the outcomes in future randomized clinical trials comparing the effectiveness of different types of bariatric procedures.

The heterogeneous etiology of mental health disorders also means that the effect of bariatric surgery is unlikely to be uniform across different psychiatric diagnostic groupings. Perioperative analgesic and sedative drugs may potentiate the risk for organic disorders, whereas postoperative complications, such as sepsis, may precipitate or exacerbate anxiety, depression, or cognitive decline. With the increasing recognition that beyond the anatomical changes of bariatric surgery there are hormonal and microbiota changes that may partially contribute to mental health outcomes after surgery, adequately powered randomized clinical trials are required to assess whether hormonal or microbiota optimization can improve patient-centered outcomes across diverse psychiatric conditions.
Conclusions

Over a mean (SD) follow-up period of 5 (2.9) years, 1 in 10 patients (10%) who underwent bariatric surgery used at least 1 episode of mental health care after bariatric surgery. We confirmed that prior psychiatric conditions were a major risk factor for requiring mental health services after bariatric surgery. Approximately 7% of the patients who did not have any prior documented psychiatric illnesses required some form of psychiatric services after surgery. Suicides accounted for about 10% of all deaths. Our findings question the hypothesis that weight reduction by bariatric surgery will improve mental health in patients with obesity.

REFERENCES


