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ORIGINAL CONTRIBUTIONS

Mental Illness and Psychotropic Medication use Among People Assessed for Bariatric Surgery in Ontario, Canada

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Abstract
Background Studies completed outside of Canada have reported a high rate of mental illness and psychotropic medication use among bariatric surgery candidates with variable impacts on surgical and mental health outcomes. To our knowledge, there has been no published Canadian data on this issue.
Methods We conducted a secondary analysis of de-identified data from the Ontario Bariatric Registry for all individuals who completed both a baseline and psychological assessment between April 1, 2010, and February 9, 2015 (N=10,698). We determined the rates of reported mental illness and psychotropic medication use overall and by fiscal year of assessment.
Results A past or present mental illness, most commonly depression, was recorded for 51 % of individuals. At baseline, 38 % were taking at least one psychotropic medication, most commonly antidepressants. Only a small proportion of the population were taking psychotropic medications known to be associated with high potential for weight gain. Although the prevalence of mental illness increased steadily from 35 % in 2010/2011 to 63 % in 2014/2015, there was no corresponding increase in reported medication use. Of those taking psychotropic medications, 13 % did not have a recorded history of mental illness.
Conclusions Consistent with other international studies, our results indicate a high prevalence of mental illness and psychotropic medication use among people referred for bariatric surgery in Ontario, Canada. This supports that accurate screening practices, knowledge about how to manage psychotropic medication pre- and post-operatively and recognition for opportunities to change medications that may be associated with weight gain are required.

Keywords Mental illness · Depression · Bariatric surgery · Psychotropic medication · Antidepressants

Introduction

Thirty-six percent, or approximately 13 million Canadians, are overweight or obese [1]. As elsewhere, obesity and obesity-related illness in Canada is associated with substantial health burden which accounts for an estimated 1 to 3 % of all annual health expenditures [2] and over seven billion Canadian dollars in direct and indirect costs [3]. At an individual level, the presence of obesity is associated with 25 % higher total healthcare costs compared to patients with normal body mass index [4]. Bariatric surgery, including gastric banding, gastric bypass and sleeve gastrectomy, is an effective treatment for morbid obesity [5, 6], with around 6000 procedures performed each year in Canada. About half of these are performed in Ontario, Canada's most populous province [2].

The relationship between depression and overweight or obesity is bidirectional with evidence that each condition is a risk factor for future development of the other [7]. As a result, there is a high prevalence of mental health conditions, especially depressive and anxiety disorders, among patients

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referred for bariatric surgery [5, 8]. Studies from the USA have reported a current and lifetime prevalence of depression among bariatric patients of 17 % [5] and 40 % [8], respectively. Moreover, at baseline, prior to surgery, up to 35 % of patients are taking antidepressants [8]. This is relevant because pre-surgery mental health issues are associated with mental health issues post-surgery, as well as surgical success [9]. It has been found that the post-surgical course of depression varies, and while many improve, others experience an initial reduction in depressive symptoms followed by a recurrence [8], and in some cases, there is continuous worsening [10]. A further complicating factor is the impact that bariatric surgery may have on psychotropic pharmacokinetics and, therefore, effectiveness [11–13]. Consequently, it is imperative for clinicians to recognize mental illness co-morbidity among bariatric patients and post-surgical challenges that may arise from these conditions and their treatments.

Although Canada, and in particular Ontario, is steadily experiencing a growth in bariatric surgery volumes, to the best of our knowledge there is no published data on the rate of mental illness in this population using Canadian data. Given international differences in healthcare system organization and access, we feel Canadian data is needed to inform local practices and policy in Canada's single payer, universal healthcare system, as well as for comparison to other healthcare settings. The aim of this study was to report on the prevalence of mental illness among patients referred for bariatric surgery in Ontario, Canada. We also sought to characterize this population from a treatment perspective in terms of baseline psychotropic medication use, including medications known to have a high propensity for weight gain.

Methods

Design and Data Sources

We conducted a secondary analysis of de-identified data from the Ontario Bariatric Registry (OBR). The OBR is an initiative of the Ontario Bariatric Network (OBN) established in 2009 as part of the Bariatric Services Strategy outlined by Ontario's Ministry of Health and Long-Term Care (MOHLTC) to address obesity and obesity-related illness [14]. The OBR is maintained by the Centre for Surgical Invention and Innovation, with collaboration from the OBN, the Population Health Research Institute (PHRI) and the MOHLTC. The multi-site, observational registry database contains information on all patients undergoing bariatric surgery at participating centres in Ontario since 2010 [15]. The OBR has research ethics approval from all participating sites where data are collected. All patients provide informed consent permitting data collection, and charts are reviewed for recorded variables. The data in the OBR are completely anonymous as no patient identifiers are collected. The study investigators submitted a data request to the OBR which was approved and raw data for the cohort were extracted by the PHRI and released in a password-protected Excel file.

Prior to receiving surgery, all individuals referred for bariatric procedures undergo a series of assessments, including a detailed demographic profile and medical review (baseline assessment) and a screening assessment for the presence of mental health conditions (psychological assessment). Our study cohort consisted of all individuals who had data recorded in the OBR for both the baseline assessment and psychological assessment between April 1, 2010, and February 9, 2015.

Prevalence of Mental Illness (Past or Present)

During the psychological assessment, the assessor determines if there is evidence of a past or present history of psychiatric illness. The assessment is a clinical interview completed by a healthcare provider who, depending on the site, may come from a range of disciplines. Most assessments are completed by a social worker, but nurses, psychologists, psychiatrist or other healthcare providers may also complete these assessments. Over time, there has been some shift in assessor type, with most assessments being completed by social workers in recent years and a higher number of nurse assessments in the initial years of the OBR. The assessments are reviewed and the required data is recorded on an assessment form that is submitted to the OBR. Data assessment forms have remained the same since the OBR's inception, but clinical practices at individual sites may have changed. The following diagnostic categories are recorded: attention-deficit disorder, bipolar disorder, depression, borderline personality disorder, panic disorder, addiction (substance not specified), posttraumatic stress disorder and anxiety (type of disorder not specified). An 'other' category is available for less common conditions. If evidence for the disorder, past or present, is identified during the assessment, it is coded as 'yes' on the data form which is submitted to the OBR and input in the Registry.

Use of Psychotropic Medications (Current)

On the baseline assessment, all current medications are recorded by name. We assessed for the following: (1) any psychotropic medication based on the definitions of psychotropic medication used by the OBR (see Appendix for complete list); (2) specific classes of medications including selective serotonin reuptake inhibitors (SSRIs), serotonin norepinephrine reuptake inhibitors (SNRIs), buproprion, mirtazapine, tricyclic antidepressants (TCAs), monoamine oxidase inhibitors (MAOIs), neuroleptics, mood stabilizers and stimulants and (3) medications known to be associated with high risk for clinically meaningful weight gain (>7 % body weight). Based on a meta-analysis of antidepressants [16], we included mirtazapine and paroxetine in this latter category. From published data on neuroleptics, we included olanzapine,

quetiapine, risperidone and clozapine [17]. Although data are less definitive, we also looked at lithium, valproic acid and carbemazepine as high weight gain propensity medications [17].

Data Analysis

Descriptive statistics were generated for rate of mental illness and psychotropic use overall and for specific diagnostic categories and medication classes, respectively. We examined each of the rates of mental illness and medication use across the fiscal year of psychological and baseline assessment, respectively, to look for variation. We also determined the rate of psychotropic medication use among those with and without a documented history of mental illness to highlight possible under-reporting or missed screening opportunities. All data analyses were conducted in SPSS version 22.

Results

Between April 1, 2010, and February 9, 2015, data had been captured in the OBR for 10,698 individuals who had undergone both a baseline assessment and a psychological assessment. The mean absolute number of days between the two assessments was 45.4 (95 % CI 43.6, 47.2). The baseline assessment occurred before the psychological assessment in 90.7 % of cases. The number of individuals with both assessments completed did vary by year with fiscal year 2012/2013 having the highest number of assessments (see Fig. 1). Overall, 5420 (50.7 %) of the individuals assessed had a past or present history of mental illness recorded on the psychological assessment. The prevalence of any mental illness exhibited a linear increase by fiscal year from 35 % in 2010/2011 to 63 % in 2014/2015 (see Fig. 1). When we included all psychotropic medications assessed on the baseline assessment (see Appendix), 4052 (37.9 %) of individuals were taking at least one medication. This remained consistent across all years of available assessment data (see Fig. 1).

Of those with a past or present history of any of the assessed mental illnesses, the most common diagnosis was depression which was identified in 4460 individuals (41.7 % of the total population, 82.3 % of those with mental illness) (see Table 1). In terms of psychiatric co-morbidity among those with a history of mental illness, 37.5 % had two or more reported conditions. An addiction co-occurring with another mental health condition was documented for 137 individuals (2.5 %).

Among those individuals identified as taking any type of psychotropic medications on the baseline assessment (n=4052), the most common medication type identified was antidepressants (n=3811, 35.6 % of the total population), and within this group, SSRIs represented the most commonly used class (n=2016, 52.9 % of those on antidepressants) (see Table 2). Among those taking psychotropic medications, the number of medications ranged from 1 to 6 with 2739 individuals (67.6 %) taking only 1 medication, 24.7 % taking 2 medications and 7.7 % taking 3 or more. The most commonly reported high weight gain propensity medications were quetiapine (n=220) and paroxetine (n=207) (see Table 3).

Of the individuals on psychotropic medication, 537 (13.3 %) had no history of mental illness documented. Within this cohort, 28.7 % were taking either trazodone or

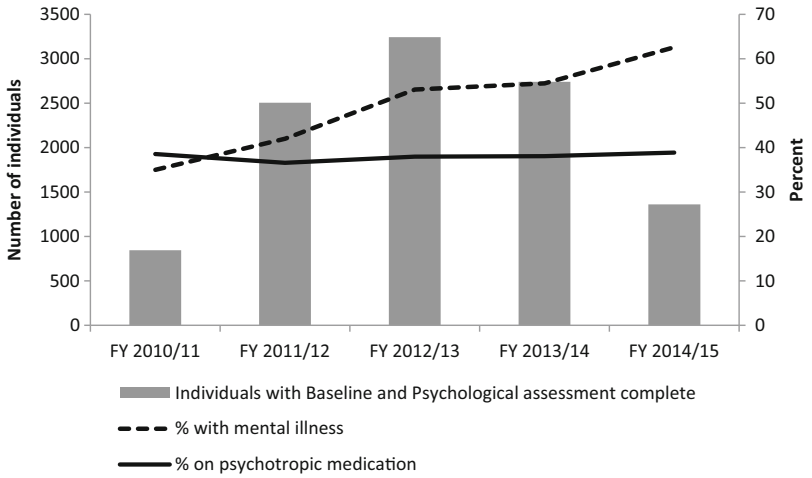

Fig. 1 Assessments captured in the Ontario Bariatric Registry by fiscal year with corresponding rates of any mental illness and any psychotropic medication use

FY: fiscal year
Note: Fiscal year 2014/15 only contains data up to February 9, 2015

Table 1 Prevalence of past or present mental illness as assessed on the psychological assessment (N=10,698)

Mental illness	Number	Percent
Any mental illness	5420	50.7
Attention-deficit disorder	201	1.9
Bipolar disorder	233	2.2
Borderline personality disorder	56	0.5
Depression	4460	41.7
Panic disorder	161	1.5
Addiction (substance not specified)	186	1.7
Post traumatic stress disorder	343	3.2
Anxiety (type not specified)	2294	21.4

amitriptyline which may be used clinically for the management of insomnia or neuropathic pain. The remainder, however, were on psychotropic medications typically used first line for the treatment of psychiatric disorders only (see Table 4). This finding was not explained by a greater length of time between baseline and psychological assessments (i.e. allowing for new medications to be started or new diagnoses to occur) nor was it explained by a higher frequency of psychological assessments occurring before baseline assessments (i.e. allowing for new diagnoses to be made and new treatments started after the psychological assessment). In the group with no mental illness history, 9.3 % had the psychological assessment first, compared to 8.7 % of the group with a mental illness history ($\chi^2(1)=0.193$, $p=0.6$).

Table 2 Reported psychotropic medication use overall and by class

Medication class	Number[a]	% of total population (N=10,698)	% of all taking any psychotropic medication
Any psychotropic medication	4052	37.9	100
Any antidepressant	3811	35.6	94.1
Any neuroleptic	435	4.1	10.7
Selective serotonin reuptake inhibitor (SSRI)	2016	18.8	49.8
Serotonergic norepinephrine reuptake inhibitor (SNRI)	1255	11.7	31.0
Buproprion	647	6.0	16.0
Mirtazapine	59	0.5	1.5
Tricyclic antidepressant (TCA)	436[b]	4.1	10.8
Monoamine oxidase inhibitory (MAOI)	3	0.0	0.0
Mood stabilizer	175	1.6	4.3
Stimulant	94	0.9	2.3
Trazodone	336	3.1	8.3
Other psychiatric	204	1.9	5.0

[a] Some may be taking more than one medication

[b] Most of these are taking amitriptyline (n=325)

Table 3 Reported use of high weight gain propensity medications

Medication name	Number	Percent[a]
Clozapine	3	0.1
Olanzapine	36	0.9
Quetiapine	220	5.4
Risperidone	77	1.9
Mirtazapine	59	1.5
Paroxetine	207	5.1
Valproic acid	38	0.9
Carbemazapine	30	0.7
Lithium	50	1.2

[a] Calculated as percent of those any psychotropic medication (n=4052)

Discussion

To our knowledge, this is the first study to report on the prevalence of mental illness and psychotropic medication use in patients assessed for bariatric surgery using Canadian data. Over half (50.7 %) of the individuals who completed a baseline and psychological assessment as part of the work-up for bariatric surgery in Ontario reported past or present mental illness. At baseline, 38 % of individuals were taking at least one psychotropic medication, with the most common drug being an SSRI antidepressant. Medication use patterns were reassuring from a side effect perspective in that only a small percentage of individuals reported taking psychotropic medications known to be associated with a high propensity for weight gain. Thirteen percent of individuals taking any

Table 4 Psychotropic medications reported among those with no recorded history of mental illness

Medication class	Number[a]	Percent[b]
Neuroleptic	33	6.1
Selective serotonin reuptake inhibitor (SSRI)	150	27.9
Serotonergic norepinephrine reuptake inhibitor (SNRI)	132	24.6
Buproprion	35	6.5
Mirtazapine	2	0.4
Tricyclic antidepressant (TCA)[c]	35	6.5
Monoamine oxidase inhibitory (MAOI)	0	0.0
Mood stabilizer	20	3.7
Stimulant	14	2.6
Trazodone	52	9.7
Amitriptyline	102	19.0

[a] Some may be taking more than one medication

[b] Calculated as percent of those taking medication with no reported history of psychiatric illness (n=537)

[c] Excluding amitriptyline

psychotropic medication had no history of mental illness documented, despite the majority of medications reported being indicated pretty exclusively for the treatment of mental disorders.

Our results are consistent with the published literature on rates of mental illness among bariatric surgery candidates from the USA [5, 8], South America [18] and Europe [19]. Moreover, our finding that 36 % were taking an antidepressant at the time of baseline assessment is strikingly similar to the 35 % reported in a longitudinal cohort study from the USA [8]. Knowledge of past and present mental illness as well as psychotropic medication use is important for the healthcare team to know. These conditions require assessment and monitoring over time, as a worsening mental health condition post-surgery may be associated with lower or less sustained weight loss and fewer perceived gains in physical health [10]. Psychotropic medication use is also important to be aware of, given the potential impact of bariatric surgery on medication pharmacokinetics [11–13]. For example, a published case report describes the recurrence of a patient's severe panic disorder post-operatively, attributed to changes in medication absorption [20].

An interesting finding from our data was the increasing rate of mental illness with later year of assessment and a corresponding lack of increase in the rate of reported psychotropic medication use. This could potentially be explained by improved screening processes over time because of a growing recognition of the impact of mental health on post-surgical outcomes. As awareness of the procedure as an option for clients in Ontario increases, however, it may also reflect the fact that a more complicated patient profile is emerging in those seeking bariatric surgery. Among these patients, many may have undertreated mental health problems. Given that suicide rates after bariatric surgery, in a number of studies outside of Canada, have been found to be four to six times higher than that of the general population [21], this highlights the need to be increasingly aware of the mental health needs of this population.

It is also interesting that a proportion of people on psychotropic medications used primarily for the treatment of mental disorders did not have a recorded history of mental illness. Possible explanations include the use of psychotropic medications to treat non-mental health conditions such as pain or insomnia which did account for some of this discrepancy or individual lack of awareness of a diagnosis for which they had been prescribed medication. More likely, it is an indication of under-reporting which has been described elsewhere [22, 23], or inadequate screening. Although not all mental health conditions were coded on the assessment, there was also an 'other' option, which did not account for this discrepancy since nearly all individuals with an 'other' diagnosis had at least one of the captured diagnoses as well.

While it is important that we produce Canadian data for comparison and to inform processes occurring locally, this study has a number of limitations. The assessment of mental illness prevalence did not differentiate between past and present illness, which limits the results in terms of identifying active illness at the time of referral. Mental health issues were also identified based on a clinical interview that was conducted by a range of healthcare providers, rather than chart review or the use of a structured clinical interview. Although the consistency of our rates with studies in other populations where another approach was used [18, 19] is reassuring, this type of reporting may result in both the over-reporting of mild conditions not meeting diagnostic criteria and the under-reporting of undiagnosed illness or situations in which a participant denied illness for fear disclosure will result in lack of access to surgery [22, 23]. As well, while a wide range of medications were captured by the assessment forms, details regarding indications and doses were not. Given that a small number of medications used to treat psychiatric conditions are also used off label for other clinical indications, this may lead to inaccurate classification. With the awareness of this limitation, we have reported medication classes and names to provide as much information as possible. Finally, we examined cross-sectional prevalence in baseline data prior to surgery; as such, findings are not necessarily generalizable to those actually undergoing surgery.

Conclusion

Our results suggest both a high rate of past and/or present mental illness, especially depression and anxiety, and psychotropic medication use among individuals undergoing a baseline assessment for bariatric surgery in Ontario. Healthcare providers should be knowledgeable about how to screen for the presence of mental illness, how to manage psychotropic medication pre- and post-operatively and recognize opportunities to change medications that may be associated with weight gain. Future work will examine the impact of mental illness in bariatric surgery candidates on surgical and mental health outcomes using Ontario data to contribute to the sparse literature on this topic.

Compliance with Ethical Standards Research ethics approval for the collection and storage of data has been obtained from all sites that participate in the Ontario Bariatric Registry.

Conflicts of Interest The authors declare that they have no competing interests.

Access to Data Statement Data used in the study were obtained from the Ontario Bariatric Registry (Anvari, M. Sharma, A. Yusuf, S. et al. 2015). The Registry is managed by Ruth Breau and the team at the Centre

for Surgical Invention and Innovation, with analysis and data management provided by the Population Health Research Institute.

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Informed Consent Informed consent is obtained from all individuals providing personal health information to the Ontario Bariatric Registry.

Appendix

Table 5 Psychotropic medications recorded on baseline assessment

Serotonin norepinephrine reuptake inhibitors (SNRIs)	Other antidepressants
Venlafaxine	Buproprion
Duloxetine	Mirtazapine
Desvenlafaxine	Trazodone
Selective serotonin reuptake inhibitors (SSRIs)	Mood stabilizers
Citalopram	Lithium
Escitalopram	Vaproic acid
Paroxetine	Lamotrigine
Sertraline	Carbamazapine
Fluvoxamine	Neuroleptics
Fluoxetine	Quetiapine
Tricyclic antidepressants (TCAs)	Olanzapine
Nortriptyline	Risperidone
Amitriptyline	Aripiprazole
Clomipramine	Ziprasidone
Imipramine	Haloperidol
Doxepin	Clozapine
Monamine oxidase inhibitors (MAOIs)	Stimulants
Moclobemide	Atomoxetine
Tranylcypromine	Dextroamphetamine
Phenelzine	Methylphenidate
Other	Other stimulants
Other psychiatric	

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