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# Depression is associated with worse outcomes among women undergoing breast reconstruction following mastectomy<sup>☆</sup>



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Received 6 July 2018; accepted 24 March 2019

## KEYWORDS

Breast reconstruction;  
Depression;  
NIS database;  
Autologous breast reconstruction;  
Implant based breast reconstruction

**Summary Background:** The causes of depression after breast reconstruction include worse outcomes, longer recovery times, and, sometimes, additional operations. Despite a plethora of data examining the effect of depression after breast reconstruction, there is little information to assess if concurrent depression affects patient outcomes in a similar manner. Thus, we sought to answer this question: Do depressed women undergoing breast reconstruction have worse outcomes?

**Methods:** The United States National Inpatient Sample was queried during 2010–2013 for all patients undergoing breast reconstruction after mastectomy. Patients with a diagnosis of depression at the time of breast reconstruction were compared to those who did not have depression at the time of breast reconstruction; patients who had any of the corresponding ICD-9 procedure codes for breast reconstruction and the single diagnostic code for depression included in their electronic medical record were included in the database sample. Significance testing and risk-adjusted multivariate logistic regression were performed with SPSS.

**Results:** A total of 175,508 patients were included in this study, of which 35,473 had depression at the time of breast reconstruction and 140,035 did not. Depression was associated with an increased age, length of stay, greater cost of care, more comorbidities, and higher incidence of pulmonary, hematologic, gastrointestinal, infectious, wound, and venous thromboembolic complications,  $p < 0.05$ . Pulmonary, genitourinary, and hematologic complications, infection, VTE, wound, and transfusion were associated with depression when a multivariate risk-adjusted regression was performed.

<sup>☆</sup> Parts of this article have been presented at the following meetings: 2017 Annual Meeting of the American Association of Plastic Surgeons in Austin, TX on 25 March 2017.

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**Conclusion:** A co-morbid diagnosis at the time of breast reconstruction should prompt the breast reconstruction team to ensure that depressed patients have their depression managed and all co-morbidities optimized and treated prior to undergoing breast reconstruction to ensure optimal patient outcomes.

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## Introduction

Breast cancer is the leading indication for breast reconstruction, with 109,256 breast reconstructions performed in 2016.<sup>1</sup> Breast cancer takes an enormous toll on patients, with many patients developing depression at some point during their care. As patient-centered care and outcomes-based practice continue to evolve the landscape of surgery, mental and emotional health can potentially serve as significant variables in our treatment algorithm. Reflecting this increasing focus on total patient care, recent studies have expanded upon the role of mental health in patient outcomes. Recently, depression has been associated with increased incidence of stroke, myocardial infarction, and cancer.<sup>33-36</sup>

Depression has been associated with a spectrum of both immediate and delayed complications—spanning increased likelihood of cardiac events,<sup>1,2</sup> prolonged/impaired wound healing,<sup>3,4,5</sup> and prolonged hospitalizations.<sup>6</sup> The result of these compounded issues is a significantly higher cost of care placed upon such individuals and our health care institutions as a whole.<sup>7,8,9</sup> As such, the role of depression in postoperative patients is fairly unknown and could serve as beneficial insight as we tailor our operative planning and clinical management.<sup>10-13</sup>

In discussing the role of depression in breast reconstruction and, subsequently, breast cancer patients, it becomes apparent that this population demonstrates greater incidence of depression.<sup>14</sup> Retrospective analyses have noted that as many as 30% of women with 1 year of a breast cancer diagnosis will develop clinically significant depression. When compared to comparable populations, the incidence of depression is 3-4 times higher in patients with breast cancer than the general populace.<sup>14</sup> Notably, recent studies have indicated chemotherapy and radiation therapy regimens as associated with higher incidences of depression—thus further compounding the likelihood of such a diagnosis in this patient population.<sup>15,16</sup>

Moreover, depression is a vague diagnosis that patients and providers are reticent to discuss and mental illness is still considered a taboo.<sup>31</sup> Despite this, many patients admit to symptoms of depression when asked by their physicians and on preappointment questionnaire forms while being treated for breast cancer.<sup>32</sup> Frequently, patients are embarrassed to discuss mental health issues and seek help for them, leading to underdiagnosis, poor documentation of mental health-related complaints, and lack of treatment. The effect of this on patients undergoing breast reconstruction is unknown, and to date, little literature exists to determine best practices for how to manage depression in patients considering breast reconstruction.

Previous research indicates that depression improves for many women after they undergo breast reconstruction.<sup>38,39</sup> Furthermore, it has been found to improve psychological wellbeing and sexual function, and allow patients to “beat” breast cancer.<sup>40</sup> Despite the medical community’s widespread agreement and acknowledgment that depression can have profound somatic effects on a patient, there has been little study on the effects depression may have on patients undergoing breast reconstruction surgery.

As we attempt to better understand our patients and the nuances of their care, investigation of the extent to which depressive disorders negatively impact surgical outcomes was undertaken. We hypothesize that clinically depressed patients undergoing postmastectomy breast reconstruction suffer worse outcomes than those without a clinical diagnosis of depression during the time of breast reconstruction. By shedding light upon the relationship that may exist between depression in women undergoing breast reconstruction and diminished postoperative outcomes, clinicians can better tailor their care to maximize patients’ chances of a successful course of recovery.

## Patients and methods

### Patient selection

A population-based analysis was conducted by identifying patients undergoing breast reconstruction using the Nationwide Inpatient Sample in the United States of America during years 2011-2013. The Nationwide Inpatient Sample is the largest all-payer inpatient care database in the United States of America. This database contains data from roughly 1000 hospitals and eight million inpatient hospital stays. This represents approximately one-fifth of all hospital discharges from nonfederal facilities and is part of the Healthcare Cost and Utilization Project (HCUP) sponsored by the Agency for Healthcare Research and Quality. HCUP gives a sample that is representative of the heterogeneous population of the US by randomly sampling 1 in 5 hospitals that are not federally funded. Federally funded hospitals include Veterans Affairs Hospitals and Military hospitals which are responsible for the care of less than 10% of the United States population and consist of mainly male patients. HCUP-included sites span the gamut from small rural critical access sites to large urban, thus generating a sample that truly represents the diversity seen in the United States.

All patients undergoing reconstruction after mastectomy were included. The ICD-9 procedure codes do not specify if a patient is undergoing immediate or delayed breast reconstruction. [Table 1](#) includes the ICD-9 procedure codes

**Table 1** Classification of reconstructive procedure-based ICD-9 procedure codes.

Type of breast reconstruction	ICD-9 Code	Procedure
Autologous	85.7	Total autologous reconstruction of breast
	85.72	TRAM flap, pedicled
	85.71	Latissimus dorsi flap
	85.7	Perforator flap, free
	85.73	TRAM flap, free
	85.74	DIEP flap, free
	85.75	SIEA flap, free
	85.76	GAP flap, free
	85.79	Other total reconstruction of breast
	85.85	Pedicled graft to breast
	85.84	Muscle graft to breast
Implant-based reconstruction	85.95	Insertion of breast tissue expander
	85.35	Bilateral subcutaneous mastectomy with synchronous implant
	85.33	Unilateral subcutaneous mastectomy with synchronous implant

**Table 2** Characteristics of patients who underwent breast reconstruction.

Parameter	No depression ( <i>n</i> = 157,454)	Depression ( <i>n</i> = 17,957)	<i>p</i>
Age (years)	51.27 ± 10.67	52.32 ± 9.93	<0.001
Gender (%)			0.539
Male	0.2	0.2	
Female	99.8	99.8	
Race (%)			<0.001
White	73.7	83.7	
Black	11.0	6.8	
Hispanic	8.3	5.6	
Asian or Pacific Islander	3.2	1.3	
Native American	0.2	0.3	
Other	3.7	2.3	
Insurance status (%)			<0.001
Medicare	12.6	16.4	
Medicaid	8.2	10.8	
Private	75.4	68.7	
Self-pay	1.0	0.8	
No charge	0.2	0.2	
Other	2.6	3.0	
Length of stay (day)	2.70	3.15	<0.001
Total charges (\$)	63,036	67,494	<0.001
Death (%)	0.0% (49)	0.0% (5)	0.813

queried. Following this, the database was queried for patients found to also have a clinical diagnosis of depression based upon the same method. This group was subsequently compared against those without a clinical diagnosis of depression and thus without a corresponding ICD-9 code (298.0) included in their medical record.

### Statistical analysis

All analyzed variables were provided by the Nationwide Inpatient Sample database. Race categories were provided by the primary data source to the Nationwide Inpatient Sample. Demographic factors were compared between depressed and nondepressed patients using Chi squared and *t*-tests as appropriate. For categorical variables (Table 2),

percentages were calculated and compared using a *t*-test with *p*-values generated as well. Finally, a risk-adjusted multivariate logistic regression was performed to compare the rate of complications between depressed and nondepressed patients. SPSS was used for all calculations. Table 2 reports the demographic characteristics of patients who underwent breast reconstruction. Table 3 reports the comorbidities in patients who underwent breast reconstruction in depressed and nondepressed cohorts. Table 4 reports the results of the univariate logistic regression comparing complications between depressed and nondepressed patients undergoing breast reconstruction. Finally, Table 5 reports the results of the risk-adjusted multivariable logistic regression of perioperative outcomes for patients who are undergoing breast reconstruction with and without depression at the time of surgery.

**Table 3** Comorbidities in patients who underwent breast reconstruction.

Parameter	No depression	Depression	<i>p</i>
Myocardial infarction	0.5	1.0	<0.001
Congestive heart failure	0.7	1.2	<0.001
Peripheral vascular disease	0.3	0.4	0.104
Cerebrovascular disease	0.2	0.5	<0.001
Dementia	0.0	0.1	<0.001
Chronic lung disease	8.0	14.8	<0.001
Rheumatoid disease	1.2	2.0	<0.001
Chronic kidney disease	0.5	1.4	<0.001
Peptic ulcer disease	0.1	0.2	0.005
Mild hepatic disease	0.6	0.9	<0.001
Uncomplicated diabetes mellitus	6.3	8.9	<0.001
Complicated diabetes mellitus	0.2	0.8	<0.001
Paralysis	0.1	0.3	<0.001
Cancer	58.5	54.9	<0.001
Mod to Severe hepatic disease	0.0	0.1	<0.001
Metastatic cancer	13.7	13.5	0.339
HIV	0.0	0.0	0.279

**Table 4** Complications in patients who underwent breast reconstruction.

Parameter	No depression	Depression	<i>p</i>
Cerebrovascular accident	0.0 (24)	0.0 (5)	0.213
Pulmonary complication	1.2	1.9	<0.001
Shock	0.1	0.1	0.268
Cardiac complication	0.4	0.3	0.265
Gastrointestinal complication	0.3	0.3	0.277
Genitourinary complication	0.2	0.3	<0.001
Hematology complication	3.0	3.6	<0.001
Infection	1.8	2.5	<0.001
VTE	0.4	0.6	<0.001
Wound complication	1.2	1.8	<0.001
Transfusion	4.3	5.8	<0.001

**Table 5** The risk-adjusted multivariable logistic regression of perioperative outcomes for patients who underwent breast reconstruction.

Outcomes	OR (95% CI)	<i>P</i>
Cerebrovascular accident	1.7 (0.67-4.6)	0.252
Pulmonary complication	1.6 (1.4-1.8)	<0.001
Shock	1.3 (0.83-2.2)	0.232
Cardiac complication	0.85 (0.65-1.1)	0.221
Gastrointestinal complication	0.84 (0.62-1.1)	0.268
Genitourinary complication	1.7 (1.2-2.3)	0.001
Hematologic complication	1.2 (1.1-1.3)	<0.001
Infection	1.4 (1.2-1.5)	<0.001
VTE	1.5 (1.2-1.8)	<0.001
Wound	1.6 (1.4-1.8)	<0.001
Transfusion	1.4 (1.3-1.5)	<0.001
Death	0.85 (0.34-2.2)	0.731

## Results

A total of 175,508 patients were included in this study, of which 35,473 had depression at the time of breast reconstruction and 140,035 did not. Depression was associated with an increased age, length of stay, greater cost of care, more comorbidities, and higher incidence of pulmonary, hematologic, gastrointestinal, infectious, wound, and venous thromboembolic complications,  $p < 0.05$ . Pulmonary, genitourinary, and hematologic complications, infection, VTE, wound, and transfusion were associated with depression when the multivariate risk-adjusted regression was performed. Those complications found to have statistical significance amongst depressed patients were further evaluated with respect to their odds ratios and confidence intervals: as such, a diagnosis of clinical depression was also associated with a statistically significant increase in patient charges and overall hospitalization length of stay.

The risk-adjusted multivariate logistic regression revealed that depression was associated with a greater burden of complications, which include statistically significant greater rate of pulmonary, genitourinary, hematological, infectious, venous thromboembolic, and transfusion-related complications. A statistically nonsignificant relationship was found between depression and the following: cerebrovascular accidents, shock, cardiac, and gastrointestinal complications. Death was not associated with depression.

## Discussion

Depression can have a huge impact on patients and ultimately claims approximately 44,500 lives a year if not treated.<sup>24</sup> Many patients exhibit signs and symptoms of depression but are embarrassed to seek for help, in fact less than 10% of depressed patients are ever treated.<sup>27</sup> Some patients may even intentionally deny symptoms of depression in fear of losing their job, as some professions do not look favorably upon individuals receiving mental healthcare.<sup>28</sup> Additionally, many physicians are reluctant to diagnose a patient with a mental health disorder for fear of stigmatizing the patient. Many physicians eschew the diagnosis and treatment of depression altogether when caring for patients with breast cancer. This has led to an underdiagnosis of depression and ultimately an undertreatment of a problem that causes much unneeded suffering, death, and higher recurrence rates.<sup>37</sup> Suicide rates have continued to rise hitting a record of approximately 800,000 worldwide in 2017.<sup>29</sup> Given the impact on healthy patients, it is a paramount to understand the implications of depression on our patients being treated for breast cancer to ensure optimal outcomes for breast reconstruction and maximize patient wellness.

The results of our study demonstrate a novel examination of the population demographics of breast cancer reconstruction patients with clinically diagnosed depression. By the evaluation of the outcomes of patients with postmastectomy breast reconstruction within the National Inpatient Sample Database, the authors identified depression having a negative influence on outcomes after the patient leaves the operating room (Table 1). Further, our study reveals the likelihood of specific complications occurring in depressed patients who underwent breast

reconstruction. Thus, providers may use this study as a guide to be better informed of the challenges that may lie ahead following breast reconstruction in depressed patients. By deepening our understanding of the complications that have arisen in these patients, plastic surgeons will be better equipped to evaluate and take care for these patients from initial consult to postoperative care.

Patients diagnosed with clinical depression were found to have higher incidences of varying postoperative complications, as demonstrated in Tables 4 and 5. These complications spanned the gamut of pulmonary dysfunction, genitourinary disease, and hematologic disorder. In the postoperative period, depressed patients had a greater incidence of VTE and wound dehiscence/complications that reached statistical significance. Unsurprisingly, this patient population also had greater lengths of stay and overall cost of care.

In examining this increased complication rate, it becomes apparent that the depressed patient poses a complex dilemma for the reconstructive surgeon. As our study demonstrates evidence-based factors associated with the diagnosis of depression, these findings accentuate the multiple complications that may arise in the treatment of this population.

Our study has limitations. Perhaps, according to many nonmental health providers, the diagnosis of depression may be perceived as subjective.<sup>30</sup> Mental illness of all types is difficult to study and quantify despite causing profound pain and suffering and, in some cases, culminating in death.<sup>24</sup> The psychiatric community has found physical signs of depression in their patients.<sup>25,26</sup>

Given that the database does not include information about outpatient encounters or ongoing treatments, we are unable to verify how depression was managed if it was treated at all and when they were diagnosed. However, researchers at the Massachusetts General Hospital have determined that the electronic medical record is an excellent tool to identify patients who are depressed regardless of who diagnosed it, or when or how the diagnosis was established.<sup>17</sup> This makes an ICD-9 code of depression in the medical record highly reliable and an excellent way to study the effect depression has on breast reconstruction in an inpatient setting. Furthermore, the diagnosis of depression in this study is recorded in the patient record at the time of surgery as it is reflected in the inpatient diagnoses contained within the patient record when the patient undergoes one of the operations of interest as part of the NIS data collection; therefore, the temporal relationship is standardized. Thus, our paper is inherently limited in the validity of our sample of interest's diagnoses. Nevertheless, by providing our rationale for choosing the National Inpatient Sample and explaining its statistical power, we believe that our data still yield meaningful information about the potential clinical impact of depression on postoperative outcomes in patients with breast reconstruction. Moving forward, a prospective study would add rigor to the analysis and shed light upon whether the relationship between depression and negative postoperative outcomes is by causation or correlation.

An additional limitation of this study is the fact that current ICD-9 procedure codes do not specify when a patient should undergo breast reconstruction.<sup>18</sup> Given this

condition, it is impossible to study the temporal relationship of when breast reconstruction is performed in depressed patients and if the timing of breast reconstruction may affect the outcomes of depressed patients. All that can be concluded is that women undergoing breast reconstruction have the diagnosis at the time surgery as the NIS records all established diagnoses based upon ICD-9 codes contained in the patient record at the time of admission. Thus, it is not possible to determine whether there is an ideal time to perform breast reconstruction in depressed patients with these data.

Because of cost limitations in which individual years must be purchased from the database, data only during 2011-2013 were included. Additionally, study was completed in 2016, making the data more contemporary. However, given the power of the findings, we believe our findings are still relevant and generalizable to the entire population undergoing breast reconstruction today. Anecdotally, in our practice, we find that our patients who are depressed at the time of breast reconstruction do worse than those who are not.

Complications in breast cancer are most commonly linked to conditions that increase the risk of reconstructive failure.<sup>19</sup> The most recognized patient-related factors are obesity, diabetes, and active smoking.<sup>20</sup> Unfortunately, given the data structure of the NIS, we were unable to examine the influence these factors had on our results, thus limiting the clinical validity of our findings. However, given the statistical power of the study, they are unlikely to affect our results. Going forward, these factors need to be addressed and controlled to better study the role that depression plays in developing complications after breast reconstruction.

To maintain a reasonable clinical scope, we chose to solely focus upon the impact of depression on outcomes of patients with postmastectomy breast reconstruction. In the future, a prospective evaluation of the effect of depression including its treatment is needed to confirm these findings and determine effect of other associated conditions including obesity, tobacco use, diabetes, substance abuse, and other mental illnesses.<sup>21-23</sup> Although the clinical impact of our findings may seem insignificant when the proportion of specific complications are examined, a total of 16.5% of depressed patients suffered complications, as opposed to 12.3% of nondepressed patients, suggesting that a depressed patient is more likely to have a complication overall after breast reconstruction. The individual odds ratio is meant to suggest the likelihood that certain complications are more likely to occur in the depressed population of patients who received breast reconstruction. This begs the following question: should a diagnosis of depression be treated like a “canary in a coal mine” prompting greater vigilance in depressed patients?

## Conclusion

Our study represents a novel analysis of patient population variables associated with depression and the result of this diagnosis on the outcome breast reconstruction. Our study has identified patient factors that may be associated with an increased risk of varying postoperative

complications in depressed patients. The identification of possible evidence-based risk factors associated with depression is a vital step in the development of screening protocols and preoperative planning. Our research, coupled with further study and analysis, could be used to formulate a comprehensive preoperative management protocol utilizing evidence-based factors to better optimize preoperative planning, improve breast reconstruction outcomes, and enhance patient wellness.

## Financial disclosure

No financial disclosures or funding for this work was provided for all authors involved.

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