Published in final edited form as:

Plast Reconstr Surg. 2018 December ; 142(6): 1411–1420. doi:10.1097/PRS.0000000000004970.

Unplanned Emergency Department Visits within 30-Days of Mastectomy and Breast Reconstruction

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Abstract

Background: Unplanned emergency department (ED) visits are often overlooked as an indicator of care quality. Our objectives were to (1) determine the rate of 30-day ED visits following mastectomy with or without immediate reconstruction, (2) perform a risk analysis of potential factors associated with ED return, and (3) assess for potentially preventable visits with a focus on returns for pain.

Methods: Using the Healthcare Cost and Utilization Project data, we identified adult women who underwent mastectomy with or without reconstruction. Multivariable logistic regression was performed to evaluate risk of unplanned ED visits. We identified and sorted diagnostic codes to investigate why patients were seeking ED care. Additionally, we performed a subgroup analysis on patients returning with a pain-related diagnosis to evaluate risk.

Results: Of 159,275 cases of mastectomy with or without immediate reconstruction, 4,917 (3.1%) experienced an unplanned return to the ED within 30 days of operation. Being younger, having any payer type other than a private payer, or having any number of comorbid conditions resulted in increased odds of revisit to ED. A substantial proportion of those who returned (23%) presented with a pain-related diagnosis. Only 0.9% of cases with a 30-day ED return were readmitted.

Conclusions: Numerous patients return to the ED within 30-days of mastectomy with or without immediate reconstruction. There is a need for policy makers and physicians to implement strategies to reduce discretionary ED utilization, specifically among younger or publically insured patients. Combining unplanned ED visits with readmission rates as a care quality indicator warrants consideration.

Keywords

Emergency department; mastectomy; breast reconstruction; unplanned hospital visits

Unplanned revisits to the hospital following surgery are common and financially expensive on the United States (US) health system. An estimated \$12-\$17 billion dollars are lost annually from unplanned hospital visits by Medicare beneficiaries alone.¹ In alignment with efforts to improve care quality and contain costs, 30-day readmission rates are a widely accepted indicator of care quality, with a higher frequency indicative of lesser quality care. The Center for Medicaid Services (CMS), for example, implemented the Health Readmission Reduction Program in 2012 to financially penalize hospitals with 30-day readmission rates greater than the national average.²

Despite extensive research on inpatient readmission following numerous procedures, ranging from simple outpatient operations, like carpal tunnel release,³ to complex operations, such as breast reconstruction^{4,5} or coronary artery bypass,⁶ few have considered the use of unplanned visits to the emergency department (ED) as a complementary quality metric. ED visits alone may represent up to 50% of unanticipated returns to acute care after discharge.^{7,8} Visits to the ED are growing in frequency,⁹ and some can be attributed to potentially preventable encounters. Such encounters include those that should have been treated in a physician's office, clinic, or an urgent care setting or could have been avoided through higher quality care.¹⁰ Finnegan et al., for instance, report that 34% of patients who returned to the ED following elective total hip and knee replacement surgery had a diagnosis related to pain, many of which may have been prevented through better pain control mechanisms prior to discharge.¹¹

The purpose of our present investigation was to analyze frequency and diagnoses upon return for unplanned ED visits following two common procedures: mastectomy with or without immediate reconstruction. In a 2014 study, Nelson et al. investigated risk of inpatient readmission after immediate breast reconstruction and found that about 5.6% of women are readmitted following mastectomy with immediate reconstruction.¹² Nonetheless, the ED utilization of these patients remains unknown. Considering that one in eight US women will be diagnosed with breast cancer,¹³ a substantial proportion of the health system efforts are directed toward this population. Identifying reasons for ED return following surgery may unveil potential areas for improvement during postoperative patient care and related outcomes, particularly if individuals are returning for potentially preventable conditions.

Our specific objectives were to (1) define rates of 30-day ED visits following mastectomy with or without immediate reconstruction, (2) perform a risk analysis of patient and clinical factors associated with ED return, and (3) analyze diagnoses upon ED return, assessing for potentially preventable visits with an increased focus on return encounters for pain. We predicted that ED utilization for individuals who underwent a more complex procedure (mastectomy with immediate reconstruction) would be greater than those for patients who underwent mastectomy alone. We also hypothesized that, regardless of procedure type, a

substantial proportion of patients would return to the ED, most with a potentially preventable pain diagnosis.

Materials and Methods

Data Source

We conducted our analysis using multiple state databases from the Healthcare Cost and Utilization Project (HCUP) developed by the Agency for Healthcare Research and Quality. HCUP has the largest assembly of longitudinal hospital administrative data in the US, containing data from as early as 1988.¹⁴ In our analysis, we linked patient encounters from three unique datasets using the *visitlink* variable. The State Inpatient Database (SID) contains data regarding hospital inpatient stay. The State Ambulatory Surgery Database (SASD) contains encounter data from ambulatory procedures and outpatient services. Finally, the Emergency Department Database (SEDD) contains data from emergency department visits that do not result in any hospital readmission. Specifically, we linked SID, SASD, and SEDD files from California (2009–2011), North Carolina (2009–2010), New York (2009–2012), and Florida (2009–2010). We included data from multiple states, each from a different region of the US, to build a broader sample. Because the HCUP dataset is publicly available and contains de-identified health information, this study was considered nonregulated by our university's Institutional Review Board.

Case Selection

Eligible cases were identified using an algorithm of International Classification of Diseases, Ninth Revision, Clinical Modification and Current Procedural Terminology codes (See Appendix 1, Supplemental Digital Content 1, which shows the Diagnostic and Procedural Codes for Mastectomy and Immediate Breast Reconstruction Definitions. This appendix is a more comprehensive overview of the study results, [INSERT HYPER LINK](#)). Figure 1 outlines the full exclusion and inclusion criteria applied to attain the final cohorts. We extracted data for all adult women who underwent a mastectomy between January 1st, 2009 and December 1st, 2012. We required that all of the cases in our sample have a corresponding diagnosis for breast cancer in the surgical claim to ensure patients were not receiving reconstruction for other reasons, such as trauma. The cohort was then split into two mutually exclusive groups based on encounters type: (1) mastectomy alone or (2) mastectomy with immediate breast reconstruction. Those who died within 30 days of operation were excluded. We also excluded cases of delayed breast reconstruction in our analysis because timing of reconstruction varies between cases and they are difficult to capture accurately using large administrative data.

Variables of Interest

Predictor variables included patient demographic data and hospital/operative characteristics. We extracted details on patient age, race, median household income, primary payer, state, and Charlson comorbidity scores to describe our study sample. Hospital/operative characteristics included hospital location (urban vs. rural), mastectomy characteristics (simple vs. radical), reconstruction characteristics (vascularized autologous tissue vs. implants), admission type (inpatient vs. outpatient), and length of stay. We created an

“unspecified” category for any patient without explicitly coded predictor variables (e.g. patients with an appropriate code for mastectomy but without further specification of simple or radical).

Our primary outcome was a 30-day ED visit following mastectomy with or without immediate reconstruction. We defined a 30-day ED visit as any return to the ED, regardless of subsequent hospital readmission, within 30 days of the index procedure. We focused primarily on 30-day ED returns because it aligns with 30-day readmission rates used as a measure of quality by the CMS. In addition, we calculated rate of readmission after 30-day ED visit using the *readmit* variable in the SEDD database.

Statistical Analysis

Patient demographic and hospital/operative characteristics were analyzed using chi-square tests. We used multiple logistic regression to compare predictors of ED return following breast reconstruction. Patient race, median household income, and hospital location were not considered in this analysis because these variables were not consistently coded between datasets. The significance level was set at $p < 0.05$. Similar, but independent, analyses were performed for cases receiving mastectomy with or without immediate reconstruction. Assuming that one's primary diagnosis upon return to the ED is an accurate representation of what drove an individual to return in the first place, we identified the all primary ICD-9 codes for visits to the ED within 30-days of operation to describe the reason for return. We classified diagnoses into the following categories: pain, wound/implant complications, infection, inflammation/edema, lymphedema, seroma, malignancy-related, other surgical complications, surgical follow-up care, and miscellaneous. We developed these categories using common complications cited in the literature,^{15–19} modifying groups based on the actual diagnoses observed. In our final step, we performed a subgroup analysis of patients who returned to the ED with a pain-related diagnosis to assess which characteristics are at increased odds of pain-related return to ED. In the case that one returned to the ED more than once during the 30-day time period, we only analyzed claims for the initial ED visit.

Results

Demographic Characteristics

A total of 159,275 encounters fit our inclusion criteria, of which 77% were for individuals who underwent mastectomy alone and 23% for patients who underwent mastectomy with reconstruction (Figure 1). Rates of 30-day unplanned ED visits among women undergoing mastectomy alone or mastectomy with reconstruction were 3.0% and 3.3%, respectively. Despite our prediction that the ED utilization for those who underwent a more complex procedure (mastectomy with immediate reconstruction) would be greater than for those who underwent mastectomy alone, the rate of revisit to ED for both cohorts were similar. Baseline characteristics of patients who returned to the ED are outlined in Table 1. The majority of women in these encounters were white and between the ages of 35 and 59. Approximately 75% of the women who underwent mastectomy with immediate reconstruction had a private payer. However, among those who underwent mastectomy without concurrent reconstruction, Medicare patients (47%) composed the largest group.

Three-quarters (75%) of mastectomy without reconstruction operations were conducted in the outpatient setting whereas only about half (52%) of mastectomy with immediate reconstruction cases were performed in an outpatient clinic.

Estimating the Risk of ED Return

Odds ratio estimates of demographic and operative factors associated with 30-day ED visits following operation are provided in Table 2. In general, younger patients were more likely to return to the ED following their procedure. Additionally, patients with any payer type other than a private payer had a significantly higher risk of returning to the ED within 30-days of surgery. For example, Medicaid patients in the mastectomy without immediate reconstruction cohort were 2.5 times more likely to return to the ED compared to individuals with a private primary payer. Patients in California (adjusted OR, 1.7 [95% CI, 1.5 to 1.8]) and patients with a higher comorbidity score had significantly increased odds for an unplanned visit to the ED in the mastectomy without immediate reconstruction cohort. There was not an increased risk of returning to the ED based on examined surgical characteristics or type of admission.

ED Visit with Pain-Related Diagnosis

The distribution of diagnoses upon 30-day ED visits is illustrated in Figure 2. Among the patients with an unplanned visit to the ED, the most common diagnoses, notwithstanding miscellaneous reasons like diarrhea or pneumonia, were pain-related (23%), wound/implant complications (9%), or care for surgical follow-up (6%). Stratifying diagnoses upon ED return by procedure type, 775 (21%) patients had a pain-related diagnosis in the mastectomy without immediate reconstruction cohort and 335 (28%) in the mastectomy with immediate reconstruction cohort. Only 0.9% of cases with a 30-day ED return experienced a subsequent readmission. Estimates of various factors associated with increased odds of 30-day ED visits with a pain-related diagnosis are presented in Table 3. In both procedural cohorts, younger patients were significantly more likely to return to the ED with a pain-related diagnosis. For example, women between 18–34 years of age who received a mastectomy with immediate breast reconstruction were 4.9 (95% CI, 2.9 to 8.2) more likely to return with a pain-related diagnosis than those over 76. Among cases in the mastectomy without immediate reconstruction cohort, odds of return to ED with a pain-related diagnosis increased with comorbidity score. This trend was not observed to be statistically significant in the mastectomy with immediate reconstruction group. The risk of returning to the ED with a pain-related diagnosis was not significantly influenced by type of admission, type of mastectomy, or other examined surgical characteristics.

Discussion

In this analysis of encounters for mastectomy with or without immediate reconstruction, we found that (1) a considerable number of patients (3.1%) returned to the ED within 30-days of surgery, of which only 0.9% were readmitted, (2) being younger, having any payer type other than a private payer, or having a higher comorbidity score led to increased odds of a 30-day ED visit following operation, and (3) of those who experience a visit to the ED within 30-days, a substantial proportion (23%) present with a pain-related diagnosis. The

importance of measuring readmission rates following various surgical procedures as a means to assess quality of care is well-recognized.^{6,12,20–25} Our findings highlight that additional recognition of unplanned, preventable returns to the ED is warranted.

There have been few investigations examining the risk of return to emergency department within 30-days of operation to date. A study on ED visits following elective hip and knee replacement found that patients with Medicaid or Medicare, as compared to patients with private insurance, were at an increased risk for returning with a pain-related diagnosis.¹¹ Likewise, we found that Medicare and Medicaid patients had both an increased risk of returning to the ED after surgery and an increased risk of returning to the ED with a pain-related diagnosis. Some have postulated that this may be attributed to the inability for individuals with Medicare to access the same outpatient clinical resources, a visit with a primary care physician for example, as patients with private insurers.^{26,27} A similar barrier may exist for Medicaid patients. Identifying factors that make an individual more likely to return to the hospital following a procedure may help identify an area of improved care. Remedial efforts to reduce 30-day ED return can be targeted towards these vulnerable populations.

Complications following mastectomy and breast reconstruction are common, which may explain the large number of unplanned postoperative hospital visits.^{15,16} Merchant et al. examined California HCUP data and found that 3.6% of women return for an unplanned readmission within 30-days following mastectomy without reconstruction and 3.4% return after a mastectomy with immediate reconstruction.⁴ Our analysis focused uniquely on 30-day ED visits, as opposed to unplanned readmissions. However, we did consider cases of unplanned readmission following a visit to the ED. In our sample, the rate of readmission following an ED visit for patients undergoing mastectomy with or without immediate reconstruction was 0.9%. In other words, 2.2% of the study sample experienced an unplanned return to the ED without subsequent readmission. This result suggest that a substantial portion of unplanned post-operative hospital visits may be left uncaptured by quality metrics that consider only readmission rates.

The CMS currently uses readmission rates as the sole indicator for unplanned hospital visits following discharge, despite the cost wasted on potentially preventable postoperative visits to the ED.²⁸ Based on the findings of our study, policy-makers should consider the use of unplanned ED visit rates, along with readmission rates, as improved indicators of care quality. Further information is needed to examine the ED utilization in other fields and for other surgical procedures to validate the use of unplanned ED visits as an added metric of care quality.

Contrary to our hypothesis, we found no significant difference in the rate of ED visit between patients undergoing mastectomy with immediate reconstruction and those without immediate reconstruction. Although impossible to explain definitively using administrative claims, it may be owing to the patient's perception of a surgical procedure. Perhaps both procedures are perceived in a similar light to the patients. Further evaluation and perhaps even patient opinions, using a qualitative assessment, would be beneficial to this argument.

Preventable ED visits are a growing problem for hospitals, physicians, and patients. Previous estimates suggest that 14–27% of all emergency department visits could be treated elsewhere, saving approximately \$4.4 billion dollars a year.²⁸ Patients who return to the ED within 30-days of operation may represent those who received lower quality service. Those who return for pain-related symptoms, for example, may simply had not received enough education on pain management during the post-operative period. About three quarters of individuals presenting to the ED for any reason report a chief complain of pain.²⁹ We found that, within 30-days of operation, 23% of return ED encounters were related to pain. Pain is a postoperative symptom experienced by roughly one-half of women undergoing mastectomy and breast reconstruction.^{19,30} If acute pain after surgery is not controlled, it may lead to an unplanned hospital visit.^{11,31,32} Some pain management techniques, such as opioid analgesics, are well-known to cause further problems like addiction or mortality and may trigger additional unplanned returns to the hospital.^{33,34} New avenues of pain-control and management must be explored. Increased participation from physicians to educate appropriate symptom management before a patient is discharged may avoid an unnecessary visit to the ED. Managing pain in a physician's office, clinic, or an urgent care setting may also help prevent a potentially unnecessary costly visit to the emergency department. In addition, policies could be implemented at the hospital-level to help direct patients towards the most appropriate and effective appropriate care.

The findings of this study should only be considered in conjunction with their limitations. Our study sample was limited to data from four states between 2009 to 2012. Though not nationally representative, our sample size was large and cases from various regions were included. It is also possible that we did not account for all potential ED visits by limiting our search to those with a visit within 30-days of the operation. This time frame has been used by numerous studies on unplanned readmission rates^{3,5,23} and emergency department visits following surgery^{11,24,35}. Finally, similar to any retrospective administrative data study, our analysis was dependent on the accuracy of the data reported. Nonetheless, the Agency for Healthcare Research and Quality employs multiple levels of quality control assurance to reduce the probability of coding errors.³⁶ Considering these limitations, future studies should permit more detailed clinical characteristics and additional control measures. Additionally, further investigation on the role and cost-effectiveness of discharge timing is needed.

As the rates of ED utilization continue to grow,⁹ it becomes increasingly important to recognize and reduce potentially preventable return visits. Identifying patients with greater risk of potentially preventable return ED visits can help inform future strategies to reduce ED utilization and promote value-based care. To align with such initiatives, targeted reforms by healthcare providers and policy makers may reduce unnecessary visits to the ED following surgery.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding: The work was supported by a Midcareer Investigator Award in Patient-Oriented Research (2 K24-AR053120-06) to Kevin C. Chung. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. Additional funding for this work was supported by awards from the Chang Gung Memorial Hospital (project CORPG3G0111 and CORPG3G0161) to Ting-Ting Chung.

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Figure 1.
Flowchart of the Patient Cohort
ED, emergency department

Figure 2.

Distribution of Diagnoses Upon ED Visits Following Mastectomy with and without Immediate Breast Reconstruction

*The miscellaneous includes all codes that did not fall into one of the other specified categories and hold little clinical relevance to the operations of interest (e.g. diarrhea). Most codes in this category had a frequency of one.

Table 1.

Characteristics of Patients with Unplanned 30-Day ED Visits

Mastectomy without Immediate Reconstruction (N=36,415)											
Mastectomy with Immediate Reconstruction (N=122,860)											
	No ED Visit			ED Visit			P Value	No ED Visit			P Value
	N	(%)		N	(%)			N	(%)		
Total	119,130	(97.0)		3,730	(3.0)			35,228	(96.7)	1,187	(3.3)
Year of Reconstruction											
2009	34,397	(28.9)		1,128	(30.2)	<0.001		9,851	(28.0)	337	(28.4)
2010	30,452	(25.6)		991	(26.6)			9,772	(27.7)	307	(25.9)
2011	33,590	(28.2)		1,059	(28.4)			9,506	(27.0)	345	(29.1)
2012	20,691	(17.4)		552	(14.8)			6,099	(17.3)	198	(16.7)
Age at Mastectomy											
18–34	1,006	(0.8)		55	(1.5)	<0.001		1,347	(3.8)	65	(5.5)
35–59	41,827	(35.1)		1,474	(39.5)			24,290	(69.0)	822	(69.3)
60–75	47,931	(40.2)		1,342	(36.0)			8,614	(24.5)	274	(23.1)
76+	28,366	(23.8)		859	(23.0)			977	(2.8)	26	(2.2)
Race											
White	79,027	(66.3)		2,143	(57.5)	<0.001		23,709	(67.3)	717	(60.4)
Black	10,231	(8.6)		553	(14.8)			2,706	(7.7)	158	(13.3)
Hispanic	12,517	(10.5)		534	(14.3)			3,442	(9.8)	159	(13.4)
Asian	6,036	(5.1)		164	(4.4)			1,524	(4.3)	36	(3.0)
Other	4,870	(4.1)		136	(3.7)			1,813	(5.2)	57	(4.8)
Missing	6,449	(5.4)		200	(5.4)			2,034	(5.8)	60	(5.1)
Primary Payer											
Private	49,299	(41.4)		1,148	(30.8)	<0.001		26,296	(74.7)	764	(64.4)
Medicare	56,552	(47.5)		1,729	(46.4)			5,492	(15.6)	204	(17.2)
Medicaid	9,265	(7.8)		685	(18.4)			2,324	(6.6)	166	(14.0)
Other	4,014	(3.4)		168	(4.5)			1,116	(3.2)	53	(4.5)

Plast Reconstr Surg. Author manuscript; available in PMC 2019 August 12.

Mastectomy without Immediate Reconstruction (N=122,860)				Mastectomy with Immediate Reconstruction (N=36,415)			
No ED Visit		ED Visit		No ED Visit		ED Visit	
N	(%)	N	(%)	N	(%)	N	(%)
—	—	—	—	1,510	(4.3)	27	(2.3)
Unspecified							

[‡]Chi-square test only performed among patients undergoing immediate breast reconstruction

Table 2.Estimating Risk of Unplanned 30-Day ED Visits^a

Mastectomy without Immediate Reconstruction (N=3,730)				Mastectomy with Immediate Reconstruction (N=1,187)					
Adjusted OR				P Value		Adjusted OR		P Value	
Year of Reconstruction									
2009	1	Reference		—		1	Reference		—
2010	0.9	(0.9–1.0)		0.15		0.9	(0.8–1.1)		0.23
2011	1.0	(0.9–1.1)		0.55		1.0	(0.9–1.2)		0.63
2012	1.0	(0.9–1.2)		0.56		1.0	(0.8–1.2)		0.78
Age at Mastectomy									
18–34	1.9	(1.4–2.5)		<0.001		2.3	(1.4–3.8)		0.001
35–59	1.4	(1.2–1.6)		<0.001		1.7	(1.1–2.6)		0.017
60–75	1.0	(0.9–1.1)		0.44		1.4	(0.9–2.1)		0.15
76+	1	Reference		—		1	Reference		—
Primary Payer									
Private	1	Reference		—		1	Reference		—
Medicare	1.4	(1.3–1.5)		<0.001		1.6	(1.3–1.9)		<0.001
Medicaid	2.5	(2.3–2.8)		<0.001		2.4	(2.0–2.8)		<0.001
Other	1.8	(1.5–2.1)		<0.001		1.7	(1.3–2.3)		<0.001
State									
California	1.7	(1.5–1.8)		<0.001		1.3	(1.1–1.5)		<0.001
Florida	1.1	(1.0–1.3)		0.004		0.9	(0.8–1.1)		0.40
North Carolina	1.3	(1.1–1.6)		0.009		1.0	(0.7–1.4)		0.92
New York	1	Reference		—		1	Reference		—
Charlson Comorbidity Score									
0	1	Reference		—		1	Reference		—
1–3	1.5	(1.4–1.6)		<0.001		1.3	(1.1–1.5)		0.001
4	1.8	(1.6–2.0)		<0.001		1.2	(0.9–1.6)		0.36
Type of Admission									
Inpatient	1.2	(1.1–1.3)		0.002		1.0	(0.9–1.1)		0.84
Outpatient	1	Reference		—		1	Reference		—
Simple vs. Radical Mastectomy									
Simple	1	Reference		—		1	Reference		—
Radical	0.9	(0.7–1.3)		0.61		1.0	(0.7–1.5)		0.96
Unspecified	0.6	(0.6–0.7)		<0.001		0.9	(0.8–1.0)		0.062
Vascularized Autologous Tissue [†]									

	Mastectomy without Immediate Reconstruction (N=3,730)		Mastectomy with Immediate Reconstruction (N=1,187)	
	Adjusted OR		Adjusted OR	
	<i>P</i> Value		<i>P</i> Value	
Vascularized Autologous Tissue	—	—	1	Reference
Tissue expander/implants	—	—	0.9 (0.8–1.1)	0.18
Vascularized Autologous Tissue and expander/implants	—	—	0.8 (0.6–1.1)	0.13
Unspecified	—	—	0.5 (0.3–0.7)	<0.001

^a Race, Median Household Income and Patient Location variables were deleted from the model to account for missing observations

[†] Chi-square test only performed among patients undergoing immediate breast reconstruction

Table 3.

Estimating the Risk of an Unplanned 30-Day ED Visits with Pain-related Diagnosis

	Mastectomy without Immediate Reconstruction and Pain-related ED diagnosis (N=775)			Mastectomy with Immediate Reconstruction and Pain-related ED diagnosis (N=335)		
	Adjusted OR		P Value	Adjusted OR		P Value
Age at Mastectomy						
18–34	4.9	(2.9–8.2)	<0.001	8.9	(2.5–31.3)	0.001
35–59	2.4	(1.9–3.2)	<0.001	5.2	(1.6–17.2)	0.007
60–75	1.4	(1.1–1.8)	0.002	2.6	(0.8–8.4)	0.11
76+	1	Reference	—	1	Reference	—
Primary Payer						
Private	1	Reference	—	1	Reference	—
Medicare	1.6	(1.2–1.9)	<0.001	2.0	(1.4–3.0)	0.001
Medicaid	2.8	(2.2–3.4)	<0.001	2.7	(2.0–3.6)	<.0001
Other	1.7	(1.2–2.4)	0.003	1.7	(1.0–2.9)	0.052
State						
California	1.3	(1.1–1.6)	0.003	1.3	(1.0–1.7)	0.065
Florida	1.2	(1.0–1.5)	0.064	1.0	(0.7–1.3)	0.93
North Carolina	0.9	(0.6–1.5)	0.79	2.1	(1.3–3.3)	0.001
New York	1	Reference	—	1	Reference	—
Charlson comorbidity score						
0	1	Reference	—	1	Reference	—
1–3	1.6	(1.3–1.8)	<0.001	0.9	(0.7–1.2)	0.60
4	1.9	(1.5–2.4)	<0.001	0.7	(0.4–1.4)	0.37
Type of admission						
Inpatient	1.2	(1.0–1.5)	0.095	1.1	(0.8–1.3)	0.67
Outpatient	1	Reference	—	1	Reference	—
Simple vs. Radical Mastectomy						
Simple	1	Reference	—	1	Reference	—
Radical	1.6	(1.0–2.7)	0.061	1.2	(0.6–2.5)	0.58
Unspecified	0.6	(0.5–0.8)	<0.001	0.8	(0.6–1.0)	0.058
Vascularized Autologous Tissue [†]						
Vascularized Autologous Tissue	—	—	—	1	Reference	—
Tissue expander/implants	—	—	—	0.9	(0.6–1.2)	0.41
Both Vascularized Autologous Tissue and Tissue expander/implants	—	—	—	1.1	(0.7–1.8)	0.70
Unspecified	—	—	—	0.4	(0.2–1.0)	0.049

[†] Chi-square test only performed among patients undergoing immediate breast reconstruction

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