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Psychiatric Disease in Surgically Treated Colorectal Cancer Patients

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Abstract

Background—Underlying psychiatric conditions may affect outcomes of surgical treatment for colorectal cancer (CRC) due to complex clinical presentation and treatment considerations. We hypothesized that patients with psychiatric illness (PSYCH) would have evidence of advanced disease at presentation, as manifested by higher rates of colorectal surgery performed in the presence of obstruction, perforation, and/or peritonitis (OPP-surgery).

Materials and Methods—Using data from the 2007–2011 National Inpatient Sample (NIS), we identified patients with a diagnosis of CRC undergoing colorectal surgery. In addition to somatic comorbid conditions flagged in the NIS, we used the Clinical Classification Software to identify patients with PSYCH, including schizophrenia, delirium/dementia, developmental disorders, alcohol/substance abuse, and other psychiatric conditions. Our study outcome was OPP-surgery. In addition to descriptive analysis, we conducted multivariable logistic regression analysis to analyze

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Contributions:

Vanessa Ho contributed to study concept, background research, manuscript preparation

Emily Steinhagen contributed to literature review and manuscript preparation

Kelsey Angell contributed to literature review and manuscript preparation

Suparna Navale contributed to data analysis and manuscript preparation

Nicholas Schiltz contributed to data preparation and data analysis

Andrew Reimer contributed to study concept and manuscript preparation

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the independent association between each of the PSYCH conditions and OPP-surgery, after adjusting for patient demographics and somatic comorbidities.

Results—Our study population included 591,561 patients with CRC and undergoing colorectal cancer surgery, of whom 60.6% were 65 years of age or older, 49.4% were women, and 6.3% had 5 or more comorbid conditions. 17.9% presented with PSYCH. The percent of patients undergoing OPP-surgery was 13.9% in the study population but was significantly higher for patients with schizophrenia (19.3%), delirium and dementia (18.5%), developmental disorders (19.7%), and alcohol/substance abuse (19.5%). In multivariable analysis, schizophrenia, delirium/dementia, and alcohol/substance abuse were each independently associated with increased rates of OPP-surgery.

Conclusion—Patients with PSYCH may have obstacles to receiving optimal care for CRC. Those with PSYCH diagnoses had significantly higher rates of OPP-surgery. Additional evaluation is required to further characterize the clinical implications of advanced disease presentation for patients with PSYCH diagnoses and colorectal cancer.

INTRODUCTION

Colorectal cancer is the second leading cause of cancer-related deaths in the United States that affects both men and women.¹ Complicated, locally advanced colon cancer occurs in up to 20% of new diagnoses and manifests as obstruction, perforation, and/or peritonitis.² These high-risk cases can present a diagnostic and therapeutic challenge as the emergent nature of the necessary surgery can outweigh surgical oncologic principles. As such, complicated presentations of colorectal cancer are associated with poorer short-term and long-term outcomes.³

Psychiatric and mental illness affects 18% of adults in a given year, and is associated with a high rate of chronic conditions and early death.⁴ Psychiatric and mental illness is also associated with worse outcomes in a variety of cancers, including colorectal, esophageal, lung, and breast cancer.^{5–7} The discrepancy in oncologic outcomes in patients with mental illness is likely due to a combination of delays in diagnosis, disparities in access to care, differential treatment, and poor adherence to therapy.^{6,8–10} Although poor outcomes in patients with psychiatric illness and colorectal cancer have been described, there are limited studies examining the mechanism by which mental illness impacts colorectal cancer mortality. Specifically, it is unknown whether patients with psychiatric conditions are more likely to present with high-risk disease.

The aim of our study was to examine the interaction between psychiatric conditions and colorectal resection in the setting of obstruction, perforation, or peritonitis in patients with colorectal cancer using the National Inpatient Sample.

MATERIALS AND METHODS

This is a cross-sectional study using 2007–2011 data from the National Inpatient Sample (NIS) of the Healthcare Cost and Utilization Project¹¹ (to evaluate the association between defined psychiatric conditions and substance abuse and emergency colorectal resection in

patients with colorectal cancer. This study was deemed exempt by the Case Western Reserve University Institutional Review Board.

Data Source

We used NIS data spanning from 2007 to 2011. Developed by the Agency for Healthcare Research and Quality (AHRQ), the NIS is an all-payer database that includes discharge summary data for over 7 million inpatient stays every year, from a 20% stratified sample of non-federal, short-term, and other specialty hospitals nationwide. In addition to patient demographics, the NIS record carries diagnosis and procedure codes in International Coding of Diseases, 9th Clinical Modification (ICD-9-CM), as well as comorbid conditions, coded according to the algorithm by Elixhauser et al.¹¹

Study Population

Our study population included all admissions for patients 18 years of age or older, carrying diagnosis codes for colorectal cancer (ICD-9-CM diagnosis codes 153.0–153.9, 154.0 – 154.9) and procedure codes indicating colorectal surgery (ICD-9-CM procedure codes 17.3, 17.41, 17.42, 17.44, 17.49, 45.7, 45.8, 45.90, 45.92, 45.93, 45.94, 45.95, 46.03, 46.04, 46.2, 48.40, 48.42, 48.43, 48.49, 48.5, 48.6).¹² These procedures included colorectal resection with anastomosis as well as diversion, performed in open or minimally invasive manner. Our analytic data set included 358,745 weighted admissions. No exclusion criteria were applied.

Variables of interest

Outcome variable—Our outcome variable was *emergency* colorectal surgery for colorectal cancer, defined as surgery, performed in the presence of the following diagnoses: obstruction (ICD-9-CM diagnosis codes 560.8 and 560.9); peritonitis (567.0, 567.2, and 567.9); or perforation (569.83).

Independent variables—Our main independent variables were psychiatric conditions, which were identified by using diagnosis codes grouped by AHRQ's Clinical Classification Software (CCS) into distinct clinical categories (<https://www.hcup-us.ahrq.gov/toolssoftware/ccs/AppendixASingleDX.txt>), including adjustment disorders (CCS 650); anxiety disorders (651); attention-deficit, conduct, and disruptive behavior disorders (652); delirium, dementia, and amnesic and other cognitive disorders (653); developmental disorders (654); disorders usually diagnosed in infancy, childhood, or adolescence (655); impulse control disorders (656); mood disorders (657); personality disorders (658); schizophrenia and other psychotic disorders (659); alcohol-related disorders (660); and substance-related disorders (661). Schizophrenia, delirium/dementia, developmental disorders, and alcohol/substance related disorders were each considered independently and the remaining diagnoses were grouped as "Other Psychiatric conditions." Due to significant coding and clinical overlap between delirium and dementia, these diagnoses could not be separated. The presence of a psychiatric condition was flagged as 'Yes' in the presence of any of the above conditions.

Additional independent variables included age, which we grouped in the 18–64 and 65 and older categories; sex (male/female); race (White, Black, Hispanic, other, missing); insurance

(Medicaid, Medicare, Private, Self-Pay/Uninsured, other, missing), median household income at the zip code level, in quartiles; count of comorbid conditions (0, 1, 2, 3, 4, 5+), based on Elixhauser's index,¹³ excluding alcohol abuse, depression, drug abuse, lymphoma, psychoses, solid tumor without metastasis, fluid/electrolyte disorders, blood loss, weight loss, and metastatic disease. We considered four of the above diagnoses (fluid/electrolyte disorders, blood loss, weight loss, and metastatic disease) to be markers of advanced disease and the patient's vulnerability to experience adverse outcomes, and they were included separately in the model.

Analysis

Descriptive analysis was performed for all individuals who underwent colorectal surgery and had a psychiatric condition and/or substance abuse disorder. We also conducted multivariable logistic regression analysis to examine the association between psychiatric conditions and substance abuse and emergency colorectal resection, adjusting for age, sex, race, income, number of comorbid conditions, and the four comorbidities that were considered markers of advanced disease. Each psychiatric disease category was compared to the patient group that had no psychiatric conditions in the multivariable model. We used survey weights to account for the complex stratified sampling strategy in the NIS. SAS version 9.4 (Cary, NC) was used in all of our analyses.

RESULTS

We identified a total of 591,561 patients aged 18 years of age or older, with colorectal cancer, and undergoing colorectal surgery. Patient characteristics are described in Table 1. Forty-nine percent were female; 64% white, and 60.6% of the population was over the age of 65. The majority of the patients had multiple comorbid conditions, with over 50% presenting with two or more comorbidities. Within our cohort, 16.2% of the population (95,824 patients) had psychiatric conditions. The most common psychiatric condition was 'Other', which was present in 59,284 (10.0%). This was followed by delirium and dementia (present in 3.7%). Within this cohort, 82,281 (13.9%) had emergency surgery, or surgery in the presence of obstruction, perforation, or peritonitis.

Table 1 presents the bivariate analysis examining the relationship between emergency surgery and for patients with and without psychiatric conditions for the age categories of 18–64 and 65 and older. Emergency colorectal surgery was more common in Black patients, Medicare patients, and Self-pay/Uninsured patients. Patients with 4 or more comorbidities had higher rates of emergency surgery. Additionally, those with electrolyte disorders, blood loss, weight loss, and metastatic disease had higher rates of emergency surgery. Patients with schizophrenia, delirium/dementia, developmental disorders, and alcohol/substance abuse were also more likely to have an emergency operation.

The multivariable regression is presented in Table 2. When compared with no psychiatric conditions, schizophrenia, delirium/dementia, and alcohol/substance abuse were all significantly associated with increased odds of emergency surgery (Odds Ratios 1.30 (95% CI 1.04–1.62), 1.26 (95% CI 1.14–1.38), 1.18 (95% CI 1.06–1.32), respectively). Presence of "Other" psychiatric condition was associated with a decreased odds of emergency surgery

(Odds Ratio 0.93 (95% CI 0.84–0.99). As the number of comorbid conditions increase, the odds of emergency surgery decreased. Other covariates significantly associated with emergency surgery included age >85, black race, electrolyte disorders, weight loss, and metastatic disease. In this multivariable analysis, presence of blood loss and multiple comorbid conditions was associated with a lower rate of emergency surgery.

DISCUSSION

Our study demonstrates that patients with psychiatric illnesses may be more likely to present with high risk features of colorectal cancer, namely obstruction, perforation, or peritonitis. Racial and socioeconomic disparities in the treatment, presentation, and outcomes of colorectal cancer have been described, as has the impact of psychiatric illness on rectal cancer treatment.^{8,14–16} However, the impact that these psychiatric conditions have on the mode of presentation for colorectal cancer has not been explored.

A complicated colon cancer presentation, which often requires emergency surgery, has important implications for both perioperative complications and long term oncologic outcomes. The need for emergency surgery related to obstruction or perforation carries a significantly higher operative risk, and worse cancer specific survival.¹⁷ Patients have not had the opportunity to undergo preoperative bowel preparation, and managing shock, obstruction, and controlling contamination may take precedent over an oncologically optimal procedure.² A large population-based study demonstrated that perforated and obstructing cancers have up to a 9% and 5% operative mortality rate, respectively, with an overall five year survival of approximately 33%, which is significantly lower than similarly staged patients who present without complications.¹⁸ Even in the non-emergent setting, patients with schizophrenia in particular have a higher rate of postoperative complications such as renal failure, pneumonia, bleeding, sepsis, stroke, and mortality for all types of surgery.¹⁹ A complicated presentation and emergency surgery only magnifies the risks for this vulnerable population.

Our study supports the hypothesis that patients with psychiatric illness present in a delayed fashion, with more advanced disease, and with more physiologic derangements. These findings are consistent with existing literature. In elderly patients particularly, an analysis of the Surveillance, Epidemiology, and End Results (SEER) linked with Medicare database demonstrated that those with psychiatric disorders were more likely to be diagnosed with colorectal cancer at autopsy, to have not undergone chemotherapy for stage 3 disease, or receive no treatment at all.⁶ Though patients with psychiatric illness were more likely to present with advanced disease, the differences persisted even when controlled for stage. These disparities likely continue into the therapeutic phase as well. Patients with psychiatric diagnoses are less likely to have surgical or endoscopic treatment for gastrointestinal cancers, or to have sphincter-preserving operations for rectal cancer.^{10,20}

Our data parallels the findings that psychiatric disorders are associated with a delay in diagnosis, different treatment, and worse outcomes in other types of cancers. In investigations of esophageal, lung, and head and neck cancers, psychiatric comorbidities were associated with delay in diagnosis and possibly inadequate cancer treatment.^{7,21,22} An

Australian study of all-cause mortality in cancer patients reported morbidity rates for cancer in psychiatric patients, with a relative risk of 1.54 for colorectal cancer.²³ This study also reported less chemotherapy in those with psychiatric illness, which has particular importance for patients whose colorectal cancer presents with obstruction, perforation, or peritonitis.

Socioeconomic factors associated with psychiatric disorders such as limited education and under- or unemployment may interfere with access to healthcare. Patients with mental illness are less likely to receive preventative cancer screenings; colorectal cancer screening in this population has been reported to be as low as 12% in a five-year period.^{9,24} In addition to access to healthcare, patients with significant psychiatric illness are more likely to have cardiovascular disease and other significant medical comorbidities which may take precedence over routine screening examinations.^{25,26} The impact of psychiatric illness on self-care can also be a limiting factor; this may lead to a lower rate of screening or follow-up on referrals made for routine colonoscopy or for early symptoms. Our finding of a higher rate of complex disease presentation amongst patients with psychiatric illness reflects decreased access to routine screening and colonoscopy. Improving access and utilization of screening for patients with psychiatric illness may help reverse our findings.

There is currently increased attention on improving colorectal cancer screening rates promoted by the “80 by 2018” initiative from the National Colorectal Cancer Roundtable (<http://nccrt.org/tools/80-percent-by-2018/>). Based on the findings of this study and other similar ones, this vulnerable patient population should receive increased attention in these types of campaigns. Improving screening rates may be an opportunity for collaboration between the gastroenterologists/surgeons who perform screening and the psychiatric care providers who are most likely to care for this group of patients. If primary care providers are aware of the tendency for patients with psychiatric comorbidities to miss recommended screening and present with complicated colorectal cancer, it may act as an impetus toward increased referrals for their patients. Psychiatrists, who may account for the majority of this populations interaction with the healthcare system, can also encourage their patients to undergo health maintenance examinations. Our findings bring light to multiple opportunities to improve colorectal screening and care for this vulnerable population.

The use of large nationwide databases has inherent limitations. We were unable to control for the severity of or treatment of any psychiatric conditions, or the effect of psychiatric or neuroleptic medications. The effects seen here might be different for patients depending on the severity of the psychiatric disease. Additionally, there may be patients who present with obstruction, perforation, or peritonitis who do not undergo an operation either because of patient and family preference, or because they are too sick to undergo surgery. We are unable to examine the impact of psychiatric illness on these decisions using this administrative data. Additionally, the presence of multiple comorbid conditions could be a surrogate for improved primary care rather than a marker of poor health, which would explain the lower rate of emergency surgery in the population with more comorbidities. Alternatively, the explanation may be that those with multiple comorbid conditions receive palliative or end-of-life care instead. There is heterogeneity of which psychiatric diagnoses are included in studies on this topic, making it somewhat difficult to compare between studies. Delirium and

dementia, although distinct but occasionally overlapping conditions, were grouped together for this study due inability to separate them using administrative data. Additionally, there may be setting-specific issues which influence emergency surgery (such as the patient's prior living situation) which could not be examined due to limitations of the NIS. However, the large sample size with reliable data is a significant strength in our study.

CONCLUSIONS

Patients with psychiatric illness may be more likely to present with advanced disease as represented by our population with obstruction, perforation, and peritonitis. This may lead to higher rates of emergency surgery, a more complicated postoperative course, and worse oncologic outcomes. It is important to determine the impact of this presentation on outcomes in patients with psychiatric disease before definitively attributing this presentation to their outcomes. On a systematic level, methods to achieve better surveillance for colorectal cancer amongst this vulnerable population need to be explored. Individual physicians must also stress the importance of routine colorectal cancer screening when caring for individuals with psychiatric comorbidities. Surgeons who care for colorectal cancer patients with psychiatric comorbidities who present with complex disease should make extra efforts to ensure they receive adequate adjuvant treatment given their overall high risk.

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Table 1

Characteristics of the study population and those with emergency procedure, stratified by age and any psychiatric condition

	Age 18 – 64						Age 65 and older					
	Any psychiatric condition			No psychiatric condition			Any psychiatric condition			No psychiatric condition		
	Total patients ¹ N (column %)	Emergency procedure ² N (row %)	Total patients ¹ N (column %)	Emergency procedure ² N (row %)	Total patients ¹ N (column %)	Emergency procedure ² N (row %)	Total patients ¹ N (column %)	Emergency procedure ² N (row %)	Total patients ¹ N (column %)	Emergency procedure ² N (row %)	Total patients ¹ N (column %)	Emergency procedure ² N (row %)
Age, mean (SD)	53.77 (7.67)	53.54 (7.74)	53.61 (8.15)	53.28 (8.44)	76.22 (7.48)	76.61 (7.94)	76.74 (7.45) ^A	76.61 (7.94)	76.74 (7.45) ^A	77.72 (7.89) ^A		
Sex:												
Male	18,376 (51.1%)	3,336 (18.2%)	108,341 (55.0%)	15,276 (14.1%)	24,522 (41.0%)	4,167 (17.0%)			147,355 (49.3%) ^A	20,086 (13.6%) ^B		
Female	17,610 (48.9%)	2,518 (14.3%)	87,969 (44.7%)	11,145 (12.7%)	35,316 (59.0%)	5,162 (14.6%)			151,321 (50.6%)	20,570 (13.6%)		
Race:												
White	22,980 (63.8%)	3,571 (15.5%)	113,850 (57.8%) ^A	14,816 (13.0%) ^B	42,249 (70.6%)	6,494 (15.4%)			198,756 (66.5%) ^A	26,899 (13.5%)		
Black	3,763 (10.5%)	830 (22.1%)	23,088 (11.7%)	3,675 (15.9%)	3,508 (5.9%)	656 (18.7%)			21,691 (7.3%)	3,379 (15.6%)		
Hispanic	2,255 (6.3%)	374 (16.6%)	14,254 (7.2%)	2,137 (15.0%)	3,014 (5.0%)	474 (15.7%)			14,513 (4.9%)	2,032 (14.0%)		
Other	1,280 (3.6%)	235 (18.4%)	12,951 (6.6%)	1,923 (14.8%)	2,068 (3.5%)	392 (19.0%)			14,031 (4.7%)	1,945 (13.9%)		
Missing	5,718 (15.9%)	844 (14.8%)	32,676 (16.6%)	3,878 (11.9%)	8,998 (15.0%)	1,314 (14.6%)			49,916 (16.7%)	6,412 (12.8%)		
Insurance:												
Medicare	5,822 (16.2%)	1,064 (18.3%)	12,876 (6.5%) ^A	1,999 (15.5%) ^A	54,262 (90.7%)	8,403 (15.5%)			261,072 (87.3%) ^A	35,815 (13.7%) ^B		
Medicaid	6,123 (17.0%)	1,197 (19.5%)	20,917 (10.6%)	4,393 (21.0%)	600 (1.0%)	181 (30.2%)			3,233 (1.1%)	552 (17.1%)		
Private	19,983 (55.5%)	2,734 (13.7%)	140,856 (71.6%)	15,888 (11.3%)	4,421 (7.4%)	659 (14.9%)			30,531 (10.2%)	3,698 (12.1%)		
Self-pay/uninsured	2,303 (6.4%)	568 (24.7%)	11,374 (5.8%)	2,551 (22.4%)	119 (0.2%)	40 (33.6%)			1,309 (0.4%)	253 (19.3%)		
Other	1,683 (4.7%)	*	10,217 (5.2%)	1,526 (14.9%)	361 (0.6%)	36 (10.0%)			2,504 (0.8%)	320 (12.8%)		
Missing	82 (0.2%)	*	580 (0.3%)	72 (12.4%)	75 (0.1%)	11 (14.7%)			259 (0.1%)	27 (10.4%)		
Median Household Income (in Quartiles):												
1 (lowest)	9,778 (27.2%)	1,647 (16.8%)	47,648 (24.2%) ^A	7,039 (14.8%)	14,675 (24.5%)	2,268 (15.5%)			73,371 (24.5%)	10,226 (13.9%)		
2	9,127 (25.4%)	1,595 (17.5%)	47,762 (24.3%)	6,416 (13.4%)	15,290 (25.6%)	2,195 (14.4%)			79,567 (26.6%)	10,450 (13.1%)		

	Age 18 – 64						Age 65 and older					
	Any psychiatric condition			No psychiatric condition			Any psychiatric condition			No psychiatric condition		
	Total patients/ N (column %)	Emergency procedure ² N (row %)	Total patients/ N (column %)	Emergency procedure ² N (row %)	Total patients/ N (column %)	Emergency procedure ² N (row %)	Total patients/ N (column %)	Emergency procedure ² N (row %)	Total patients/ N (column %)	Emergency procedure ² N (row %)	Total patients/ N (column %)	Emergency procedure ² N (row %)
3	8,329 (23.1%)	1,355 (16.3%)	48,066 (24.4%)	6,505 (13.5%)	15,081 (25.2%)	2,338 (15.5%)	71,727 (24.0%)	2,338 (15.5%)	71,727 (24.0%)	9,873 (13.8%)		
4 (highest)	7,828 (21.7%)	1,113 (14.2%)	48,581 (24.7%)	5,810 (12.0%)	13,703 (22.9%)	2,354 (17.2%)	68,836 (23.0%)	2,354 (17.2%)	68,836 (23.0%)	9,403 (13.7%)		
Missing	934 (2.6%)	139 (14.9%)	4,763 (2.4%)	660 (13.9%)	1,089 (1.8%)	173 (15.9%)	5,407 (1.8%)	173 (15.9%)	5,407 (1.8%)	711 (13.2%)		
Count of Comorbid Conditions:												
0	8,331 (23.1%)	1,424 (17.1%)	70,167 (35.7%) ^A	8,789 (12.5%) ^A	3,993 (6.7%)	648 (16.2%)	39,895 (13.3%) ^A	648 (16.2%)	39,895 (13.3%) ^A	5,819 (14.6%) ^A		
1	10,757 (29.9%)	1,696 (15.8%)	61,575 (31.3%)	8,149 (13.2%)	11,421 (19.1%)	1,660 (14.5%)	74,407 (24.9%)	1,660 (14.5%)	74,407 (24.9%)	10,042 (13.5%)		
2	8,259 (22.9%)	1,345 (16.3%)	35,831 (18.2%)	5,316 (14.8%)	14,991 (25.1%)	2,348 (15.7%)	76,356 (25.5%)	2,348 (15.7%)	76,356 (25.5%)	9,909 (13.0%)		
3	4,880 (13.6%)	827 (16.9%)	18,048 (9.2%)	2,419 (13.4%)	12,905 (21.6%)	1,929 (14.9%)	53,670 (18.0%)	1,929 (14.9%)	53,670 (18.0%)	7,106 (13.2%)		
4	2,410 (6.7%)	373 (15.5%)	7,403 (3.8%)	1,164 (15.7%)	8,636 (14.4%)	1,520 (17.6%)	30,429 (10.2%)	1,520 (17.6%)	30,429 (10.2%)	4,339 (14.3%)		
5+	1,357 (3.8%)	189 (13.9%)	3,796 (1.9%)	593 (15.6%)	7,892 (13.2%)	1,224 (15.5%)	24,151 (8.1%)	1,224 (15.5%)	24,151 (8.1%)	3,452 (14.3%)		
Markers of Advanced Disease:												
Electrolyte disorders	8,829 (24.5%)	2,598 (29.4%)	30,669 (15.6%) ^A	9,242 (30.1%) ^A	20,783 (34.7%)	5,077 (24.4%)	75,741 (25.3%) ^A	5,077 (24.4%)	75,741 (25.3%) ^A	17,981 (23.7%) ^A		
Blood loss	1,962 (5.5%)	434 (22.1%)	7,965 (4.0%) ^A	1,484 (18.6%) ^C	5,356 (9.0%)	732 (13.7%)	20,223 (6.8%) ^A	732 (13.7%)	20,223 (6.8%) ^A	2,789 (13.8%)		
Weight loss	3,855 (10.7%)	1,546 (40.1%)	11,968 (6.1%) ^A	5,047 (42.2%) ^A	7,980 (13.3%)	2,410 (30.2%)	28,730 (9.6%) ^A	2,410 (30.2%)	28,730 (9.6%) ^A	9,845 (34.3%)		
Metastatic disease	13,715 (38.1%)	3,295 (24.0%)	71,894 (36.5%) ^C	15,162 (21.1%)	17,929 (30.0%)	4,256 (23.7%)	91,741 (30.7%)	4,256 (23.7%)	91,741 (30.7%)	19,659 (21.4%) ^C		
Psychiatric Conditions:												
Schizophrenia	1,758 (4.9%)	399 (22.7%)			3,685 (6.2%)	651 (17.7%)		651 (17.7%)				
Delirium/Dementia	885 (2.5%)	203 (22.9%)	N/A	N/A	20,879 (34.9%)	3,818 (18.3%)	N/A	3,818 (18.3%)	N/A	N/A		
Developmental disorders	1,323 (3.7%)	288 (21.8%)			1,104 (1.8%)	190 (17.2%)		190 (17.2%)				
Alcohol/Substance abuse	9,004 (25.0%)	1,887 (21.0%)			8,189 (13.7%)	1,460 (17.8%)		1,460 (17.8%)				
Other Psychiatric	26,209 (72.8%)	3,732 (14.2%)			33,075 (55.3%)	4,409 (13.3%)		4,409 (13.3%)				
Outcomes of Interest:												
Obstruction	4,119 (11.4%)		18,665 (9.5%) ^A		7,143 (11.9%)		29,796 (10.0%) ^A					

	Age 18 – 64						Age 65 and older					
	Any psychiatric condition			No psychiatric condition			Any psychiatric condition			No psychiatric condition		
	Total patients ¹ N (column %)	Emergency procedure ² N (row %)	Total patients ¹ N (column %)	Emergency procedure ² N (row %)	Total patients ¹ N (column %)	Emergency procedure ² N (row %)	Total patients ¹ N (column %)	Emergency procedure ² N (row %)	Total patients ¹ N (column %)	Emergency procedure ² N (row %)	Total patients ¹ N (column %)	Emergency procedure ² N (row %)
Peritonitis	1,728 (4.8%)		7,237 (3.7%) ^A		1,890 (3.2%)		9,437 (3.2%)		7,192 (2.4%)		9,437 (3.2%)	
Perforation	1,060 (2.9%)		4,351 (2.2%) ^B		1,430 (2.4%)		7,192 (2.4%)		7,192 (2.4%)		7,192 (2.4%)	
Total	35,996	5,854 (16.3%)	196,820 (13.4%)	26,430	59,838 (15.6%)	9,329	298,908 (13.6%)	40,667				

¹ P-values are comparing any psychiatric condition to no psychiatric condition within each age group.

² P-values are comparing any psychiatric condition to no psychiatric condition within each age group among those with emergency procedure.

P-values are denoted as superscripts: A = $p < 0.0001$, B = $p = 0.0001$ $p < 0.01$, C = $p = 0.05$

* Denotes cells with counts < 11. In accordance with privacy rules, these cells, as well as cells in corresponding rows were masked

Table 2

Multivariable model for emergency resection using each psychiatric condition

Variable	Odds ratio (95% CI)	p-value
Age group:		
18 – 64	Reference	
65 +	0.95 (0.89 – 1.00)	0.0668
Sex:		
Male	Reference	
Female	0.89 (0.86 – 0.93)	< 0.0001
Race:		
White	Reference	
Black	1.09 (1.02 – 1.17)	0.0081
Hispanic	1.05 (0.96 – 1.14)	0.2842
Other	1.07 (0.99 – 1.16)	0.0924
Missing	0.91 (0.86 – 0.97)	0.0052
Insurance:		
Medicare	1.17 (1.10 – 1.25)	< 0.0001
Medicaid	1.54 (1.43 – 1.67)	< 0.0001
Private	Reference	
Self-pay/uninsured	1.83 (1.65 – 2.02)	< 0.0001
Other	1.18 (1.05 – 1.33)	0.0051
Missing	1.01 (0.66 – 1.56)	0.9588
Median Household Income (in Quartiles):		
1 (lowest)	0.98 (0.93 – 1.02)	.2999
2 – 4	Reference	
Count of Comorbid Conditions:		
0	Reference	
1	0.90 (0.86 – 0.95)	0.0003
2	0.87 (0.82 – 0.92)	< 0.0001
3	0.80 (0.74 – 0.85)	< 0.0001
4	0.82 (0.76 – 0.89)	< 0.0001
5+	0.72 (0.66 – 0.79)	< 0.0001
Markers of Advanced Disease:		
Electrolyte disorders	2.53 (2.43 – 2.64)	< 0.0001
Blood loss	0.85 (0.79 – 0.92)	< 0.0001
Weight loss	2.99 (2.85 – 3.15)	< 0.0001
Metastatic disease	2.27 (2.18 – 2.35)	< 0.0001
Psychiatric Conditions:		

Variable	Odds ratio (95% CI)	p-value
Schizophrenia vs No Psych	1.30 (1.04 – 1.62)	0.0201
Delirium/Dementia vs No Psych	1.26 (1.14 – 1.38)	< 0.0001
Developmental Disorders vs No Psych	1.11 (0.80 – 1.53)	0.5337
Alcohol/Substance Abuse vs No Psych	1.18 (1.06 – 1.32)	0.0032
Other Psychiatric Conditions vs No Psych	0.93 (0.87 – 0.99)	0.0287
Multiple Psychiatric Conditions vs No Psych	1.10 (0.96 – 1.25)	0.1827