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In-hospital mortality in patients emergently admitted with intestinal adhesive obstruction: An analysis of more than 115,000 patients

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Abstract

Background: The goal of our study was to assess risk factors associated with in-hospital mortality for patients emergently admitted with the primary diagnosis of intestinal or peritoneal adhesions with obstruction in a large national dataset.

Methods: Patients from the National Inpatient Sample database (2005-2014) with intestinal or peritoneal adhesions and obstruction were analyzed. The relationship between mortality and the predictors was assessed using stratified analysis, and multivariable logistic regression models.

Results: 58,670 adults and 68,434 elderly patients (age 65+ years) were included in the study. The mean age (standard deviation, SD) of adult patients was 48.82 (11.90) for males and 50.15 (10.34) years for females. The mean age (SD) of elderly patients was 76.71 (7.37) for males and 77.89 (7.83) years for females. 60.8% of adult patients and 62.9% of elderly patients were female. In adult patients managed surgically, 1.1% died, while in elderly patients treated surgically, the mortality rate was 5.7%. The mortality of patients treated non-surgically in both age groups were significantly lower, 0.2% and 1.3%, respectively (P<0.001). The odds ratios (95% confidence interval) of risk factors for mortality in adult patients who underwent surgery were 1.071 for time to operation (1.051-1.092) 1.583 for invasive diagnostic procedure (1.177-2.129), 1.063 for age (1.049-1.077), and 0.761 for female sex (0.615-0.942). The odds ratios of risk factors for mortality in adult patients treated non-operatively were 1.099 for age (1.045-1.157), and 1.093 for hospital length of stay (1.060-1.126). The odds ratios of risk factors for mortality in elderly patients treated operatively were 1.059 for time to operation (1.046-1.071), 1.282 for invasive diagnostic procedure (1.104-1.488), 1.077 for age (1.070-1.084), and 0.706 for female sex (0.643-0.776). The odds ratios of risk factors for mortality in elderly patients who did not receive an operation were 1.108 for age (1.091-1.124), 1.050 for hospital length of stay (1.028-1.072, P<0.001), and 0.705 for female sex (0.568-0.874).

Conclusion: Delayed operation, extended hospital length of stay, invasive diagnostic procedures, age, and male sex were significant risk factors for in-hospital mortality in patients with intestinal or peritoneal adhesions with obstruction admitted emergently. Mortality in patients treated non-surgically was significantly lower.

Keywords: Peritoneal Adhesion, Intestinal Adhesion, Obstruction, In-hospital Mortality, Time to Operation

Introduction

Intestinal or peritoneal adhesions are among the most common causes of intestinal obstructions requiring emergency admission to hospital. The most common cause of adhesion formation is previous surgery. These patients often need to undergo re-operative surgery and the elderly face special risks for mortality when this condition occurs alongside concomitant comorbidities. Adhesions occur in more than 90% of patients following major abdominal surgery and in 55-100% of women undergoing pelvic surgery.[1] Small-bowel obstruction, infertility, chronic abdominal and pelvic pain, and difficult re-operative surgery are the most common consequences of peritoneal adhesions,[2] and subsequently bowel obstruction is common in clinical practice.[3] Adhesions are costly to treat and create a major economic burden for the healthcare system.[4] These findings suggest that adhesions with obstruction are of great concern from a clinical viewpoint. The pathophysiology of adhesions is complex but there has been an interest in reducing their creation and subsequently associated morbidity and mortality.[3,4,5] Adhesions with obstruction are particularly burdensome with small bowel obstructions accounting for 65% of these cases.[6] There is less adhesion creation with the use of laparoscopic surgery.[7] While recent studies have suggested potential mechanisms on pathophysiology of adhesion formation,[8] pharmaceutical prevention of adhesions is still experimental,[9] and there is still no biomarker available to predict the occurrence or the extent and severity of adhesions preoperatively,[10] until they present clinically.[11,12] Some improvements in outcome have been made with re-operations on adhesions,[13] but the best steps for reducing morbidity and mortality after they occur remain unclear.[14,15] The aim of this study was to assess risk factors associated with in-hospital mortality for patients emergently admitted with the primary diagnosis of intestinal or peritoneal adhesions with obstruction in the National Inpatient Sample (NIS) 2005-2014.

Methods

This was a retrospective cohort study of extracted The National Inpatient Sample (NIS) database as part of the Healthcare Cost and Utilization Project (HCUP), a project sponsored by the Agency for Healthcare Research and Quality (AHRQ). The data on adult and elderly patients with a primary diagnosis of intestinal or peritoneal adhesions with obstruction admitted emergently to the hospital. The sample was extracted from the NIS-2005-2014 database.

Patient Characteristics

Patient characteristics were evaluated based on race (White, Black, Hispanic, Asian/Pacific Islander, Native American and other), income quartile, total charges in dollars, insurance status (private insurance, Medicare, Medicaid, self-pay, no charge and other), hospital

location (rural, urban non-teaching and urban teaching), and co-morbid diseases (AIDS, alcohol abuse, deficiency anemias, rheumatoid arthritis, chronic blood loss, congestive heart failure, chronic pulmonary disease, coagulopathy, depression, diabetes, uncomplicated, diabetes, chronic complications, drug abuse, hypertension, hypothyroidism, liver disease, lymphoma, fluid/electrolyte disorders, metastatic cancer, other neurological disorders, obesity, paralysis, peripheral vascular disorders, psychoses, pulmonary circulation disorders, renal failure, solid tumor, peptic ulcer, valvular disease, weight loss), and mortality.

Statistical Analysis

The results analyzed in this study were stratified according to the characteristics of interest, including age (65 and over vs. under 65), operation status (operation vs. no operation), sex categories, and clinical outcomes (survived or deceased). Following stratification, descriptive and analytical statistical indicators were used to present the findings. Mean, standard deviation (SD), and confidence interval at 95% (CI) were calculated for numerical values. Categorical values were compared using chi-square analysis, and continuous variables were compared using a two-sample standard t-test, which used continuous variables to test whether the mean values of two populations/variables were statistically different. The behavior of different variables in predicting mortality was evaluated by multivariable logistic regression analysis. The least significant variables were eliminated in a stepwise manner. Both multivariable models were adjusted for the following attributes of patients and hospitals: age, sex, race, income quartile, health insurance, hospital location, invasive diagnostic procedures, and time to operation. The P-values less than 0.05 were considered significant. All analyses were done by SPSS software version 24 (SPSS Inc., Chicago, IL) and R statistical software (Foundation for Statistical Computing, Vienna, Austria).

Results

Adult Patients

Sex Differences

Our sample included a total number of 58,670 adult patients, 60.8% of whom were female. Adult females had a higher mean age, and a longer average time to operation (Table 1). Adult males had higher total charges. There was no significant sex difference in hospital length of stay (HLOS) for this patient sample. Most patients were White, funded mostly by Medicare, and were admitted evenly to urban teaching or non-teaching hospitals. Major comorbidities among emergently admitted patients were hypertension, deficiency anemias, chronic pulmonary disease, congestive heart failure, uncomplicated diabetes, and fluid/electrolyte disorders. Males had significantly higher comorbidities such as alcohol abuse, coagulopathy, liver disease, and chronic pulmonary disease, while females showed higher rate of deficiency anemias, hypothyroidism, and obesity.

Mortality

Overall, in hospital mortality of this cohort of patients was 0.7%. The mean age of patients who died was significantly higher compared to those who survived (Table 2). 55.9% of deceased patients were female. Requiring an operation was associated with higher mortality in adult patients. Those who died manifested significantly higher rates of comorbidities (Table 2). In addition, this group of patients had longer time to operation, were more likely to undergo an invasive diagnostic procedure, had higher total charges, and had longer HLOS. Comorbidities associated with mortality across both groups were deficiency anemias, congestive heart failure, coagulopathy, liver disease, fluid/electrolyte disorders, metastatic, cancer, other neurological disorders, paralysis, peripheral vascular disorders, pulmonary, circulation disorders, renal failure, solid tumor, and weight loss (Table 2).

Operative Status

The stratified analysis, based on having an operation or not, is presented in Table 3. There were 37,637 (64.1%) patients that had an operation, while 21,120 (35.9%) did not. Patients who had an operation had a mean age of 1 year older than patients who did not. The racial breakdown, by proportion of cases in decreasing order, was White, Black, Hispanic, Asian/Pacific Islander, and Native American (Table 3). Most patients in both groups were funded by Medicare. Many comorbidities were less common in patients who underwent operations than in those who did not. Patients with no operation experienced a lower mortality rate than patients who received an operation (0.2% vs 1.1%, $P<0.001$). Additionally, patients with no operation had lower rates of invasive diagnostic procedures and a shorter HLOS compared to the group that underwent an operation (Table 3).

Risk Factors for Mortality

Multivariable regression models showed that in adult patients who had operations, time to operation, invasive diagnostic procedure, male gender and age were the main risk factors for mortality (Table 4). In adult patients with no operation, age, and HLOS were the main risk factors for mortality (Table 4). As seen in Table 4, each year of age was associated with a 6.3% or 9.9% increased risk of mortality for patients who underwent and did not undergo operation, respectively. Each day of delay to operation was associated with a 7.1% increased risk of mortality to patients who had an operation. Each additional day of hospital stay was associated with a 9.3% increase in risk of mortality to patients who did not have an operation. Female patients had a 24% reduction in mortality in patients if they underwent an operation. Combination of invasive diagnostic procedures and surgery was associated with a 58% increase in mortality. Income quartile was positively correlated with mortality for patients in the first-or second quartiles who had an operation. Those who received an operation at rural hospitals had lower mortality. Race and insurance type were removed by backward elimination in both regression models. Income quartile, hospital location, invasive diagnostic procedure and sex were removed by backward elimination for patients who did not have an operation.

Elderly Patients

Sex Differences

A total number of 68,434 elderly patients (age 65+ years) with the primary diagnosis of intestinal or peritoneal adhesions with obstruction were included in the current study. Of these patients, 62.9% were female. Elderly females had a higher mean age, a longer average time to operation, and a longer mean HLOS than males (Table 1). Elderly males had higher total charges. Most patients were White, funded mostly by Medicare, and were admitted evenly to urban teaching and non-teaching hospitals. Major comorbidities among the emergently admitted patients were hypertension, deficiency anemias, chronic pulmonary disease, congestive heart failure, uncomplicated diabetes, and fluid/electrolyte disorders. Males had significantly higher comorbidities such as alcohol abuse, coagulopathy, liver disease, and chronic pulmonary disease, while females showed higher rate of deficiency anemias, hypothyroidism, and obesity.

Mortality

Overall, in hospital mortality of this cohort of patients was 4.1%. The mean age of patients who died was significantly higher compared to those who survived (Table 2). 58.4% of deceased patients were female. Undergoing an operation was associated with higher mortality in elderly patients. Those who died manifested significantly higher rates of comorbidities (Table 2). In addition, this group of patients had longer time to operation, were more likely to undergo an invasive diagnostic procedure, had higher total charges, and had longer HLOS. Comorbidities associated with mortality across both groups were deficiency anemias, congestive heart failure, coagulopathy, liver disease, fluid/electrolyte disorders, metastatic, cancer, other neurological disorders, paralysis, peripheral vascular disorders, pulmonary, circulation disorders, renal failure, solid tumor, weight loss, and chronic pulmonary disease (Table 2).

Operative Status

The stratified analysis, based on having an operation or not, is presented in Table 3. There were 42,246 (61.8%) patients that had an operation, while 26,110 (38.2%) had no operation. There was no significant difference in age between elderly patients who had an operation and those who did not. The racial breakdown, by proportion of cases in decreasing order, was White, Black, Hispanic, Asian/Pacific Islander, and Native American (Table 3). Most patients in both groups were funded by Medicare. Many comorbidities were less common in patients who had operations than in patients who did not. Patients who did not have an operation experienced a lower mortality rate than patients who had an operation (1.3% vs 5.7%, $P<0.001$). Patients with no operation also had lower rates of invasive diagnostic procedures and a shorter HLOS compared to those that who had an operation (Table 3).

Risk Factors for Mortality

In elderly patients who had operations, time to operation, having an invasive diagnostic procedure, Black race, male gender and age were the main risk factors for mortality (Table 5). In elderly patients with did not have operations, male gender, age and HLOS were the main risk factors for mortality (Table 5). As seen in Table 5, each year of age was associated with a 7.7% or 10.8% increased risk of mortality for patients who had and did not have operation, respectively. Each day of delay to operation was associated with a 5.9% increased risk of mortality to patients who had an operation. Each additional day of hospital stay was associated with a 5%

increased risk of mortality in patients who did not have an operation. Female sex was associated with a 30% decreased mortality rate across both groups. Those who had an invasive diagnostic procedure and underwent an operation had 28% higher mortality. Income quartile in the first or third quartiles was associated with mortality in patients who underwent an operation. Black patients who underwent surgery experienced mortality at a 25% greater rate than White patients. Insurance type and hospital location were removed via backward elimination for patients who had an operation. Race, income quartile, insurance type, and hospital location were removed via backward elimination for patients who did not have an operation.

Associated Mortality Risk of Additional Procedures

Patients were also stratified based on age group, survival outcome, and the type of procedure they received (Table 6). Among adult patients who had a surgical procedure either as part of or in addition to treatment of their adhesions with obstruction such as operations on the esophagus, stomach, intestine, gallbladder and biliary track, hernia, and other operations in the abdominal region had increased mortality. Among elderly patients who had a surgical procedure, such as operations on the esophagus, stomach, intestine, rectum, rectosigmoid and perirectal tissue, liver, gallbladder and biliary tree, pancreas, hernia, and other operations in the abdominal region had also increased mortality. Among adult patients who underwent an invasive diagnostic procedure, procedure on the intestine, liver and other operations in the abdominal region were associated with increased mortality. Elderly patients who had an invasive diagnostic procedure, procedure on the intestine and other operations in the abdominal region had also increased mortality. Pancreatic operations in elderly patients were associated with the highest rate of mortality (20%), followed by operations on elderly patients on the esophagus (12.5%) and stomach (11.8%).

Discussion

Operative Status

Our findings have demonstrated that, in patients presenting with bowel obstructions due to a primary diagnosis of intestinal or peritoneal adhesions admitted emergently and requiring an operation, the following were the main risk factors for mortality: time to operation, having an invasive diagnostic procedure, male gender and age.

Race

We found that Black patients who underwent surgery experienced mortality at a 25% greater rate than White patients. We found no differences in mortality rate among patients who did not undergo surgery in terms of race. The higher rate of mortality among Black patients undergoing surgery is within the range of 20-50% higher than White patients found for all major surgeries within the US between 2005-2014.[16,17] There are many complex socioeconomic factors to which this phenomenon has been attributed, such as Black patients initially seeking care late and at a more advanced stage of disease, having inadequate access to timely care, receiving most of their care at low-quality hospitals, and experiencing delayed referral patterns as compared to white patients.[17]

Age

The average surgical patient in most developed countries is becoming older. Currently, 40% of all surgeries are performed on patients older than 64 years and increasing age itself remains an important risk factor for postoperative morbidity and mortality.[18] With an aging population exposed to a higher cumulative risk of developing intestinal or peritoneal adhesions with obstruction after both minimally invasive and open surgery, the management of intestinal or peritoneal adhesions with obstruction will continue to be a central focus of surgical disease. Age was associated with mortality in both adult and elderly patients in this sample. Part of this association is related to being more acutely ill, as evidenced by the larger share of comorbidities found in the elderly group. They have higher prevalence of comorbidities both before and after operations. The following comorbidities were more prevalent in deceased group than in the surviving group in our study: deficiency anemias, chronic blood loss, congestive heart failure, chronic pulmonary disease, coagulopathy, uncomplicated diabetes, diabetes with chronic complications, hypertension, hypothyroidism, liver disease, fluid/electrolyte disorders, metastatic cancer, other neurological disorders, obesity, paralysis, peripheral vascular disorders, pulmonary circulation disorders, renal failure, solid tumor, valvular disease, and weight loss. Ceresoli et al. demonstrated that advanced-age-associated heart and lung dysfunction, impaired mental status, and oral anticoagulant therapy were independently associated with major complications and mortality.[19] Age has been found to be an independently associated risk factor for mortality in the emergent setting of tracheostomy

complications, emergent gastroparesis, and paralytic ileus.[20,21,22] This holds true in the setting of umbilical hernias, with elderly patients facing three times greater risk of mortality as compared to adult patients.[23] Intestinal obstruction is also more likely to lead to electrolyte and acid-base imbalances in elderly patients and higher rates of mortality and morbidity.[24]

Sex

Our findings demonstrated that male sex was a risk factor for mortality in emergently admitted elderly and adult patients with the primary diagnosis of intestinal or peritoneal adhesions with obstruction. This result is consistent with the increased mortality seen among males in other studies examining emergent surgery regardless of operation type.[20,21,22,25,26] Although females had significantly higher rates of several comorbidities such as obesity, depression, hypertension, hypothyroidism, and diabetes, their survival rates were higher.

Hospital length of stay (HLOS) and time to operation

There have been limited studies analyzing the relationship between HLOS and mortality in the context of intestinal obstruction from adhesions emergently admitted. We found that extended HLOS was associated with increased mortality in all patient subsample groups, with every additional day increasing mortality odds by 9% in adult patients and 5% in elderly patients. These are similar findings to those presented by Davies et al., which established that advanced age, comorbidities, and delay to treatment contribute to less favorable outcomes and prolonged inpatient stays.[27] HLOS has been found to be an independent risk factor for mortality in other emergent conditions such as chest wall trauma, hemorrhoids, rectal or rectosigmoid junction malignancy, and emergent admission for chronic duodenal ulcers.[28,29,30,31] These findings suggest that, even in patients who do not undergo surgery, time to treatment is an important factor in determining outcomes in emergent settings. An analysis of independent predictors of mortality in patients emergently admitted for arterial embolism and thrombosis concluded that delayed operating room access was significantly associated with increased mortality and HLOS.[32] Patient complexity is also associated with HLOS in the elective setting of total hip arthroplasty.[33] Giving priority to these complex patients may reduce their HLOS and associated rates of mortality. Additionally, we found that in patients who were operated on, each day of delayed time to operation was associated with an increased mortality rate of 7% in adult patients and 6% in elderly patients. This association has been found in other emergent situations such as ventral hernia repair and thrombosis.[34,35] Levy et al. also concluded that increased time to operation was a significant risk factor for mortality in patients emergently admitted for empyema.[36] Ducic et al. found that odds for favorable clinical outcomes are severely diminished when surgical intervention is questionable in patients with acute aortic occlusion.[37] This is potentially related to delayed intervention and the resulting increased HLOS. Overall, our results and the supporting literature indicate that increased HLOS should be utilized as an easily manageable prognostic factor in patients with adhesions that require emergent treatment. Beyond prognostic utility, we recommend actively addressing factors influencing HLOS to reduce the risk of nosocomial infections, morbidity, and mortality.

Our finding of delayed time to operation being associated with increased mortality is similar to findings by Chamary et al., who investigated elderly patients diagnosed with femoral hernias with intestinal obstruction and found that a delay in operation correlated to an increase in morbidity and mortality.[38] Furthermore, Arenal et al. found that delay in surgical treatment and ASA grade positively correlated with increased mortality in elderly patients operated on for an acute abdomen.[39]

Moreover, patients who received operative interventions experienced a higher mortality rate than patients who did not. These findings are similar to those demonstrated by Elgar et al. and Patel et al.[40,41] It is likely that patients who received operations were more acutely ill, as evidenced by the larger share of comorbidities found in this patient group.

Improving outcomes in emergency surgery is a complex problem and requires a multifaceted approach with great clinical and systemic implications. McGillicuddy et al. looked at elderly patients undergoing emergent colorectal procedures at high risk for morbidity and mortality and found that minimizing the delay to definitive operative care may improve outcomes.[42] Using the National Inpatient Sample from 2009, Dean et al. demonstrated that the negative effects of delayed operation are more pronounced in elderly patients. Delay in the management of small bowel obstruction is associated with death and longer postoperative stays.[43] McIsaac et al. added that delayed operating room access for emergency surgery was associated with an increased risk of in-hospital mortality,

longer HLOS, and higher costs.[44] Prolonged HLOS of older patients in the emergency department has been shown to be associated with a higher risk of hospitalization and adverse outcomes.[45] Adhesions have already been a target for personalized medicine strategies.[46] The need for careful management of patients presenting with intestinal or peritoneal adhesions with obstruction is further supported by the results we have obtained in this study. Furthermore, minimizing delay to operation is critical in decreasing mortality in these patients.

Strengths of the Study

The Healthcare Cost and Utilization Project (HCUP) was established to provide countrywide population-based data on patients in a uniform format. The data are designed for health services research to enhance health care provision. The National Inpatient Sample (NIS), a large administrative database produced by the Agency for Healthcare Research and Quality (AHRQ), has been progressively used publicly as a countrywide data source, supporting the assessment of patterns of care and outcomes for research. It allows novel approaches to investigate disease conditions, optimal care, and patient outcomes. The analysis of the epidemiology of a large sample size of patients with intestinal or peritoneal adhesions with obstruction can provide additional insights. Previous studies assessing the prevalence of intestinal or peritoneal adhesions with obstruction were confined to small populations from single hospitals or geographic regions. To the best of our knowledge, no previous study has examined in depth the epidemiology, demographics, hospitalization, complications, morbidity, and mortality of intestinal or peritoneal adhesions with obstruction across populations. Our study fills this gap in part by expanding the evidence base and further elucidating the comorbidities and outcomes associated with intestinal or peritoneal adhesions with obstruction.

Limitations of the Study

The retrospective design of this study has limitations in recognizing several confounding factors such as the choice of operative approach, the surgical team's expertise, severity of comorbidities, cause of death, and any further modifiable factors that may impact postoperative outcomes.

Conclusions

Our analysis found that every additional day of HLOS was associated with an increase in mortality rate of 9% in adult patients and 5% in elderly patients. In addition, our analysis found that in patients who were operated on, each day of delayed time to operation was associated with an increased mortality rate of 7% in adult patients and 6% in elderly patients. These findings support additional exploration into methods for reducing HLOS and delay to operation in patients emergently admitted with intestinal adhesive obstruction.

Author Contributions:

Author Contributions: Conceptualization, A.T., A.S. and R.L.; Data Curation, A.S.; Formal analysis, A.S.; Investigation, J.S., A.T., R.L. and A.S.; Methodology, A.S. and R.L.; Project administration, A.S. and R.L.; Supervision, A.S. and R.L.; Validation, A.S. and R.L.; Writing-original draft, A.T. and J.S.; Writing-review & editing, J.S., A.T., R.L. and A.S. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement: Patient consent was waived due to use of a public data set with no patient identifiers.

Data Availability Statement: National Inpatient Sample database can be found on the Healthcare Cost & Utilization Project website through the following URL, https://www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp

Conflict of Interest Disclosure Statement

The authors have no conflict of interest to declare.

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Table 1. Characteristics of emergently admitted patients with the primary diagnosis of intestinal or peritoneal adhesions with obstruction. Data was stratified according to sex categories, NIS 2005-2014.

		Adult, N (%)			Elderly, N (%)		
		Male	Female	P	Male	Female	P
All Cases		22,993 (39.2%)	35,677(60.8%)		25,351 (37.1%)	42,992(62.9%)	
Race	White	13,466 (68.2%)	20,858(68.2%)	<0.001	17,954 (81.9%)	29,902(80.4%)	<0.001
	Black	3,068 (15.5%)	5,388 (17.6%)		1,812 (8.3%)	3,729 (10.0%)	
	Hispanic	2,013 (10.2%)	2,632 (8.6%)		1,149 (5.2%)	2,027 (5.5%)	
	Asian/Pacific Islander	517 (2.6%)	859 (2.8%)		564 (2.6%)	778 (2.1%)	
	Native American	87 (0.4%)	108 (0.4%)		79 (0.4%)	105 (0.3%)	
	Other	583 (3.0%)	736 (2.4%)		371 (1.7%)	642 (1.7%)	
Income Quartile	Quartile 1	5,519 (24.7%)	8,328 (23.9%)	0.009	5,547 (22.3%)	9,587 (22.6%)	<0.001
	Quartile 2	5,432 (24.3%)	8,603 (24.6%)		6,171 (24.8%)	10,932(25.8%)	
	Quartile 3	5,780 (25.8%)	8,835 (25.3%)		6,398 (25.7%)	10,942(25.8%)	
	Quartile 4	5,632 (25.2%)	9,152 (26.2%)		6,767 (27.2%)	10,868(25.7%)	
Insurance	Private Insurance	13,028 (56.8%)	21,558(60.6%)	<0.001	2,435 (9.6%)	3,179 (7.4%)	<0.001
	Medicare	3,637 (15.9%)	5,496 (15.4%)		22,404 (88.5%)	39,028(90.9%)	
	Medicaid	2,628 (11.5%)	4,651 (13.1%)		195 (0.8%)	419 (1.0%)	
	Self-Pay	2,225 (9.7%)	2,282 (6.4%)		85 (0.3%)	120 (0.3%)	
	No Charge	253 (1.1%)	282 (0.8%)		8 (0.0%)	13 (0.0%)	
	Other	1,156 (5.0%)	1,333 (3.7%)		193 (0.8%)	177 (0.4%)	
Hospital Location	Rural	2,608 (11.3%)	3,836 (10.8%)	0.002	3,571 (14.1%)	5,811 (13.5%)	0.100
	Urban: Non-Teaching	9,897 (43.0%)	15,841 (44.4%)		11,885 (46.9%)	20,369 (47.4%)	
	Urban: Teaching	10,488 (45.6%)	16,000 (44.8%)		9,895 (39.0%)	16,812 (39.1%)	
Comorbidities	AIDS	101 (0.4%)	65 (0.2%)	<0.001	13 (0.1%)	2 (0.0%)	<0.001
	Alcohol Abuse	1,103 (4.8%)	494 (1.4%)	<0.001	583 (2.3%)	257 (0.6%)	<0.001
	Deficiency Anemias	2,110 (9.2%)	5,115 (14.3%)	<0.001	4,057 (16.0%)	8,196 (19.1%)	<0.001
	Rheumatoid Arthritis	219 (1.0%)	1,211 (3.4%)	<0.001	466 (1.8%)	1,859 (4.3%)	<0.001
	Chronic Blood Loss	135 (0.6%)	294 (0.8%)	0.001	237 (0.9%)	508 (1.2%)	0.003
	Congestive Heart Failure	505 (2.2%)	807 (2.3%)	0.6	3,090 (12.2%)	5,376 (12.5%)	0.2
	Chronic Pulmonary Disease	2,547 (11.1%)	5,498 (15.4%)	<0.001	5,902 (23.3%)	9,062 (21.1%)	<0.001
	Coagulopathy	649 (2.8%)	808 (2.3%)	<0.001	1,310 (5.2%)	1,446 (3.4%)	<0.001
	Depression	1,637 (7.1%)	5,391 (15.1%)	<0.001	1,465 (5.8%)	4,712 (11.0%)	<0.001
	Diabetes, Uncomplicated	2,662 (11.6%)	3,911 (11.0%)	0.021	4,887 (19.3%)	7,264 (16.9%)	<0.001
	Diabetes, Chronic Complications	331 (1.4%)	481 (1.3%)	0.3	642 (2.5%)	910 (2.1%)	<0.001
	Drug Abuse	944 (4.1%)	1,084 (3.0%)	<0.001	114 (0.4%)	221 (0.5%)	0.2
	Hypertension	8,366 (36.4%)	11,899(33.4%)	<0.001	16,410 (64.7%)	28,927(67.3%)	<0.001

Comorbidities	Hypothyroidism	819 (3.6%)	4,134 (11.6%)	**<0.001**	2,218 (8.7%)	9,217 (21.4%)	**<0.001**
	Liver Disease	916 (4.0%)	874 (2.4%)	**<0.001**	424 (1.7%)	592 (1.4%)	**0.002**
	Lymphoma	146 (0.6%)	149 (0.4%)	**<0.001**	323 (1.3%)	382 (0.9%)	**<0.001**
	Fluid/Electrolyte Disorders	6,888 (30.0%)	11,638(32.6%)	**<0.001**	10,570 (41.7%)	20,820(48.4%)	**<0.001**
	Metastatic Cancer	749 (3.3%)	1,187 (3.3%)	0.6	994 (3.9%)	1,333 (3.1%)	**<0.001**
	Other Neurological Disorders	1,089 (4.7%)	1,701 (4.8%)	0.8	1,693 (6.7%)	2,940 (6.8%)	0.4
	Obesity	1,576 (6.9%)	3,776 (10.6%)	**<0.001**	1,169 (4.6%)	2,538 (5.9%)	**<0.001**
	Paralysis	545 (2.4%)	313 (0.9%)	**<0.001**	373 (1.5%)	462 (1.1%)	**<0.001**
	Peripheral Vascular Disorders	728 (3.2%)	1,028 (2.9%)	**0.048**	2,922 (11.5%)	3,566 (8.3%)	**<0.001**
	Psychoses	955 (4.2%)	1,750 (4.9%)	**<0.001**	479 (1.9%)	1,020 (2.4%)	**<0.001**
	Pulmonary Circulation Disorders	190 (0.8%)	274 (0.8%)	0.4	507 (2.0%)	1,195 (2.8%)	**<0.001**
	Renal Failure	1,071 (4.7%)	1,073 (3.0%)	**<0.001**	3,765 (14.9%)	3,828 (8.9%)	**<0.001**
	Solid Tumor	432 (1.9%)	723 (2.0%)	0.2	1,045 (4.1%)	1,039 (2.4%)	**<0.001**
	Peptic Ulcer	17 (0.1%)	20 (0.1%)	0.4	24 (0.1%)	26 (0.1%)	0.1
	Valvular Disease	322 (1.4%)	788 (2.2%)	**<0.001**	1,625 (6.4%)	3,016 (7.0%)	**0.002**
	Weight Loss	1,726 (7.5%)	2,744 (7.7%)	0.4	3,163 (12.5%)	5,877 (13.7%)	**<0.001**
Invasive Diagnostic Procedure		1,602 (7.0%)	2,943 (8.2%)	**<0.001**	1,744 (6.9%)	2,877 (6.7%)	0.3
Surgical Procedure		14,372 (62.5%)	23,218 (65.1%)	**<0.001**	15,286 (60.3%)	26,956 (62.7%)	**<0.001**
Invasive or Surgical Procedure		14,646 (63.7%)	23,891 (67.0%)	**<0.001**	15,633 (61.7%)	27,537 (64.1%)	**<0.001**
Deceased		194 (0.8%)	246 (0.7%)	**0.034**	1,154 (4.6%)	1,622 (3.8%)	**<0.001**
		Mean (SD)	**Mean (SD)**	**P**	**Mean (SD)**	**Mean (SD)**	**P**
Age, Years		48.82 (11.90)	50.15 (10.34)	**<0.001**	76.71 (7.37)	77.89 (7.83)	**<0.001**
Time to Invasive Diagnostic Procedure, Days		4.52 (7.43)	3.95 (5.47)	0.2	5.43 (7.31)	4.88 (6.33)	0.1
Time to Surgical Procedure, Days		2.19 (3.16)	2.28 (3.05)	**<0.001**	2.65 (3.13)	2.76 (3.12)	**<0.001**
Hospital Length of Stay, Days		8.04 (8.74)	7.84 (8.03)	0.4	9.40 (8.74)	9.42 (8.05)	**<0.001**
Total Charges, Dollars		53,391 (82,643)	51,157 (69,166)	**0.016**	64,678 (86,608)	61,934 (76,088)	**<0.001**

Table 2. Characteristics of emergently admitted patients with the primary diagnosis of intestinal or peritoneal adhesions with obstruction. Data was stratified according to outcome categories, NIS 2005-2014.

		Adult, N (%)			Elderly, N (%)		
		Survived	**Deceased**	**P**	**Survived**	**Deceased**	**p**
All Cases		58,292 (99.3%)	440 (0.7%)		65,545 (95.9%)	2,777 (4.1%)	
Sex, Female		35,425 (60.9%)	246 (55.9%)	**0.034**	41,349 (63.1%)	1,622 (58.4%)	**<0.001**
Race	**White**	34,067 (68.2%)	242 (65.1%)	**0.004**	45,919 (81.0%)	1,914 (80.1%)	**<0.001**
	Black	8,361 (16.7%)	90 (24.2%)		5,253 (9.3%)	287 (12.0%)	
	Hispanic	4,618 (9.3%)	26 (7.0%)		3,076 (5.4%)	98 (4.1%)	
	Asian/Pacific Islander	1,370 (2.7%)	6 (1.6%)		1,291 (2.3%)	51 (2.1%)	
	Native American	194 (0.4%)	1 (0.3%)		176 (0.3%)	8 (0.3%)	
	Other	1,311 (2.6%)	7 (1.9%)		982 (1.7%)	31 (1.3%)	
Income Quartile	**Quartile 1**	13,708 (24.1%)	145 (34.4%)	**<0.001**	14,417 (22.4%)	712 (26.1%)	**<0.001**
	Quartile 2	13,907 (24.4%)	127 (30.2%)		16,420 (25.5%)	679 (24.9%)	
	Quartile 3	14,557 (25.6%)	75 (17.8%)		16,629 (25.8%)	703 (25.8%)	
	Quartile 4	14,746 (25.9%)	74 (17.6%)		16,998 (26.4%)	629 (23.7%)	

Insurance	**Private Insurance**	34,492 (59.3%)	145 (33.0%)		5,442 (8.3%)	172 (6.2%)	
	Medicare	8,965 (15.4%)	165 (37.5%)		58,860 (89.9%)	2,550 (92.0%)	
	Medicaid	7,191 (12.4%)	93 (21.1%)	**<0.001**	587 (0.9%)	27 (1.0%)	**0.007**
	Self-Pay	4,494 (7.7%)	23 (5.2%)		198 (0.3%)	8 (0.3%)	
	No Charge	533 (0.9%)	1 (0.2%)		20 (0.0%)	1 (0.0%)	
	Other	2,476 (4.3%)	13 (3.0%)		355 (0.5%)	15 (0.5%)	
Hospital Location	**Rural**	6,406 (11.0%)	38 (8.6%)		8,973 (13.7%)	405 (14.6%)	
	Urban: Non-Teaching	25,595 (43.9%)	181 (41.1%)	0.060	31,001 (47.3%)	1,246 (44.9%)	**0.039**
	Urban: Teaching	26,291 (45.1%)	221 (50.2%)		25,571 (39.0%)	1,126 (40.5%)	
Comorbidities	**AIDS**	160 (0.3%)	6 (1.4%)	**<0.001**	15 (0.0%)	0 (0%)	0.9
	Alcohol Abuse	1,566 (2.7%)	31 (7.0%)	**<0.001**	806 (1.2%)	34 (1.2%)	0.9
	Deficiency Anemias	7,141 (12.3%)	83 (18.9%)	**<0.001**	11,652 (17.8%)	594 (21.4%)	**<0.001**
	Rheumatoid Arthritis	1,411 (2.4%)	18 (4.1%)	**0.023**	2,245 (3.4%)	78 (2.8%)	0.080
	Chronic Blood Loss	420 (0.7%)	9 (2.0%)	**0.001**	705 (1.1%)	41 (1.5%)	**0.047**
	Congestive Heart Failure	1,254 (2.2%)	58 (13.2%)	**<0.001**	7,594 (11.6%)	868 (31.3%)	**<0.001**
	Chronic Pulmonary Disease	7,947 (13.6%)	95 (21.6%)	**<0.001**	14,102 (21.5%)	857 (30.9%)	**<0.001**
	Coagulopathy	1,368 (2.3%)	90 (20.5%)	**<0.001**	2,378 (3.6%)	376 (13.5%)	**<0.001**
	Depression	6,984 (12.0%)	42 (9.5%)	0.1	5,984 (9.1%)	188 (6.8%)	**<0.001**
	Diabetes, Uncomplicated	6,505 (11.2%)	66 (15.0%)	**0.011**	11,708 (17.9%)	439 (15.8%)	**0.006**
	Diabetes, Chronic Complications	796 (1.4%)	16 (3.6%)	**<0.001**	1,463 (2.2%)	89 (3.2%)	**0.001**
	Drug Abuse	2,012 (3.5%)	17 (3.9%)	0.6	328 (0.5%)	7 (0.3%)	0.070
	Hypertension	20,095 (34.5%)	165 (37.5%)	0.1	43,772 (66.8%)	1,547 (55.7%)	**<0.001**
	Hypothyroidism	4,929 (8.5%)	24 (5.5%)	**0.024**	11,070 (16.9%)	362 (13.0%)	**<0.001**
	Liver Disease	1,732 (3.0%)	58 (13.2%)	**<0.001**	949 (1.4%)	67 (2.4%)	**<0.001**
	Lymphoma	292 (0.5%)	3 (0.7%)	0.490	674 (1.0%)	31 (1.1%)	0.6
	Fluid/Electrolyte Disorders	18,254 (31.3%)	267 (60.7%)	**<0.001**	29,574 (45.1%)	1,800 (64.8%)	**<0.001**
	Metastatic Cancer	1,877 (3.2%)	58 (13.2%)	**<0.001**	2,156 (3.3%)	169 (6.1%)	**<0.001**
	Other Neurological Disorders	2,735 (4.7%)	53 (12.0%)	**<0.001**	4,363 (6.7%)	269 (9.7%)	**<0.001**
	Obesity	5,322 (9.1%)	30 (6.8%)	0.090	3,634 (5.5%)	72 (2.6%)	**<0.001**
	Paralysis	835 (1.4%)	23 (5.2%)	**<0.001**	765 (1.2%)	70 (2.5%)	**<0.001**
	Peripheral Vascular Disorders	1,717 (2.9%)	38 (8.6%)	**<0.001**	6,081 (9.3%)	404 (14.5%)	**<0.001**
	Psychoses	2,680 (4.6%)	22 (5.0%)	0.6	1,441 (2.2%)	57 (2.1%)	0.6
	Pulmonary Circulation Disorders	431 (0.7%)	33 (7.5%)	**<0.001**	1,549 (2.4%)	153 (5.5%)	**<0.001**
	Renal Failure	2,079 (3.6%)	65 (14.8%)	**<0.001**	6,999 (10.7%)	590 (21.2%)	**<0.001**
	Solid Tumor	1,140 (2.0%)	16 (3.6%)	**0.011**	1,959 (3.0%)	125 (4.5%)	**<0.001**
	Peptic Ulcer	37 (0.1%)	0 (0%)	0.9	46 (0.1%)	4 (0.1%)	0.1
	Valvular Disease	1,096 (1.9%)	14 (3.2%)	**0.046**	4,376 (6.7%)	260 (9.4%)	**<0.001**
	Weight Loss	4,345 (7.5%)	124 (28.2%)	**<0.001**	8,245 (12.6%)	787 (28.3%)	**<0.001**
Invasive Diagnostic Procedure		4,483 (7.7%)	64 (14.5%)	**<0.001**	4,338 (6.6%)	281 (10.1%)	**<0.001**
Surgical Procedure		37,215 (63.8%)	403 (91.6%)	**<0.001**	39,797 (60.7%)	2,425 (87.3%)	**<0.001**
Invasive or Surgical Procedure		38,161 (65.5%)	405 (92.0%)	**<0.001**	40,715 (62.1%)	2,435 (87.7%)	**<0.001**
		Mean (SD)	**Mean (SD)**	**P**	**Mean (SD)**	**Mean (SD)**	**P**
Age, Years		49.58 (11.01)	54.87 (8.00)	**<0.001**	77.28 (7.63)	81.69 (7.65)	**<0.001**
Time to Invasive Diagnostic Procedure, Days		4.10 (6.18)	7.92 (8.49)	**<0.001**	4.96 (6.60)	6.98 (8.04)	**<0.001**

Time to Surgical Procedure, Days	2.23 (3.06)	3.76 (4.89)	**<0.001**	2.67 (3.07)	3.43 (3.86)	**<0.001**
Hospital Length of Stay, Days	7.84 (8.15)	16.67 (18.56)	**<0.001**	9.23 (7.97)	13.68 (13.51)	**<0.001**
Total Charges, Dollars	51,049 (71,822)	182,461 (213,615)	**<0.001**	60,037 (75,519)	131,130 (135,199)	**<0.001**

Table 3. Characteristics of emergently admitted patients with the primary diagnosis of intestinal or peritoneal adhesions with obstruction. Data was stratified according to operation status, NIS 2005-2014.

		Adult, N (%)			Elderly, N (%)		
		No Operation	**Operation**	**P**	**No Operation**	**Operation**	**P**
All Cases		21,120 (35.9%)	37,637 (64.1%)		26,110 (38.2%)	42,246 (61.8%)	
Sex, Female		12,459 (59.1%)	23,218 (61.8%)	**<0.001**	16,036 (61.4%)	26,956 (63.8%)	**<0.001**
Race	**White**	12,755 (69.9%)	21,569 (67.2%)	**<0.001**	18,648 (81.8%)	29,211 (80.4%)	**<0.001**
	Black	2,446 (13.4%)	6,011 (18.7%)		1,664 (7.3%)	3,878 (10.7%)	
	Hispanic	1,896 (10.4%)	2,749 (8.6%)		1,415 (6.2%)	1,761 (4.8%)	
	Asian/Pacific Islander	604 (3.3%)	772 (2.4%)		628 (2.8%)	714 (2.0%)	
	Native American	59 (0.3%)	136 (0.4%)		64 (0.3%)	120 (0.3%)	
	Other	483 (2.6%)	836 (2.6%)		376 (1.6%)	637 (1.8%)	
Income Quartile	**Quartile 1**	4,420 (21.4%)	9,441 (25.7%)	**<0.001**	5,190 (20.2%)	9,945 (24.0%)	**<0.001**
	Quartile 2	4,786 (23.2%)	9,254 (25.2%)		6,344 (24.7%)	10,763 (25.9%)	
	Quartile 3	5,520 (26.7%)	9,118 (24.8%)		6,645 (25.8%)	10,967 (25.8%)	
	Quartile 4	5,920 (28.7%)	8,904 (24.3%)		7,530 (29.3%)	10,107 (24.3%)	
Insurance	**Private Insurance**	12,444 (59.0%)	22,204 (59.2%)	**<0.001**	2,135 (8.2%)	3,482 (8.3%)	0.8
	Medicare	3,750 (17.8%)	5,384 (14.3%)		23,492 (90.1%)	37,949 (90.0%)	
	Medicaid	2,514 (11.9%)	4,771 (12.7%)		232 (0.9%)	382 (0.9%)	
	Self-Pay	1,441 (6.8%)	3,077 (8.2%)		72 (0.3%)	134 (0.3%)	
	No Charge	174 (0.8%)	361 (1.0%)		6 (0.0%)	15 (0.0%)	
	Other	758 (3.6%)	1,738 (4.6%)		146 (0.6%)	224 (0.5%)	
Hospital Location	**Rural**	2,350 (11.1%)	4,096 (10.9%)	**<0.001**	3,526 (13.5%)	5,857 (13.9%)	**<0.001**
	Urban: Non-Teaching	9,957 (47.1%)	15,830 (42.1%)		12,833 (49.1%)	19,430 (46.0%)	
	Urban: Teaching	8,813 (41.7%)	17,711 (47.1%)		9,751 (37.3%)	16,959 (40.1%)	
Comorbidities	**AIDS**	55 (0.3%)	111 (0.3%)	0.4	5 (0.0%)	10 (0.0%)	0.7
	Alcohol Abuse	437 (2.1%)	1,160 (3.1%)	**<0.001**	242 (0.9%)	598 (1.4%)	**<0.001**
	Deficiency Anemias	2,199 (10.4%)	5,027 (13.4%)	**<0.001**	3,959 (15.2%)	8,295 (19.6%)	**<0.001**
	Rheumatoid Arthritis	575 (2.7%)	855 (2.3%)	**0.001**	955 (3.7%)	1,370 (3.2%)	**0.004**
	Chronic Blood Loss	68 (0.3%)	361 (1.0%)	**<0.001**	134 (0.5%)	612 (1.4%)	**<0.001**
	Congestive Heart Failure	378 (1.8%)	934 (2.5%)	**<0.001**	2,412 (9.2%)	6,057 (14.3%)	**<0.001**
	Chronic Pulmonary Disease	2,712 (12.8%)	5,334 (14.2%)	**<0.001**	5,229 (20.0%)	9,736 (23.0%)	**<0.001**
	Coagulopathy	370 (1.8%)	1,088 (2.9%)	**<0.001**	686 (2.6%)	2,070 (4.9%)	**<0.001**
	Depression	2,817 (13.3%)	4,211 (11.2%)	**<0.001**	2,531 (9.7%)	3,646 (8.6%)	**<0.001**
	Diabetes, Uncomplicated	2,652 (12.6%)	3,922 (10.4%)	**<0.001**	4,986 (19.1%)	7,166 (17.0%)	**<0.001**
	Diabetes, Chronic Complications	322 (1.5%)	490 (1.3%)	**0.026**	617 (2.4%)	935 (2.2%)	0.2
	Drug Abuse	743 (3.5%)	1,286 (3.4%)	0.5	126 (0.5%)	209 (0.5%)	0.8
	Hypertension	7,643 (36.2%)	12,625 (33.5%)	**<0.001**	17,870 (68.4%)	27,472 (65.0%)	**<0.001**
	Hypothyroidism	1,967 (9.3%)	2,986 (7.9%)	**<0.001**	4,606 (17.6%)	6,830 (16.2%)	**<0.001**

	Liver Disease	793 (3.8%)	997 (2.6%)	**<0.001**	460 (1.8%)	556 (1.3%)	**<0.001**
	Lymphoma	118 (0.6%)	177 (0.5%)	0.1	298 (1.1%)	407 (1.0%)	**0.025**
	Fluid/Electrolyte Disorders	5,738 (27.2%)	12,792 (34.0%)	**<0.001**	9,488 (36.3%)	21,903 (51.8%)	**<0.001**
	Metastatic Cancer	752 (3.6%)	1,184 (3.1%)	**0.007**	818 (3.1%)	1,509 (3.6%)	**0.002**
	Other Neurological Disorders	976 (4.6%)	1,814 (4.8%)	0.280	1,571 (6.0%)	3,063 (7.3%)	**<0.001**
	Obesity	2,076 (9.8%)	3,276 (8.7%)	**<0.001**	1,669 (6.4%)	2,038 (4.8%)	**<0.001**
	Paralysis	262 (1.2%)	596 (1.6%)	**0.001**	245 (0.9%)	590 (1.4%)	**<0.001**
Comorbidities	**Peripheral Vascular Disorders**	382 (1.8%)	1,374 (3.7%)	**<0.001**	2,057 (7.9%)	4,432 (10.5%)	**<0.001**
	Psychoses	999 (4.7%)	1,706 (4.5%)	0.2	484 (1.9%)	1,015 (2.4%)	**<0.001**
	Pulmonary Circulation Disorders	99 (0.5%)	365 (1.0%)	**<0.001**	463 (1.8%)	1,239 (2.9%)	**<0.001**
	Renal Failure	827 (3.9%)	1,317 (3.5%)	**0.010**	2,813 (10.8%)	4,780 (11.3%)	**0.029**
	Solid Tumor	419 (2.0%)	737 (2.0%)	0.8	764 (2.9%)	1,320 (3.1%)	0.1
	Peptic Ulcer	11 (0.1%)	26 (0.1%)	0.4	19 (0.1%)	31 (0.1%)	0.9
	Valvular Disease	378 (1.8%)	732 (1.9%)	0.1	1,616 (6.2%)	3,025 (7.2%)	**<0.001**
	Weight Loss	690 (3.3%)	3,780 (10.0%)	**<0.001**	1,256 (4.8%)	7,784 (18.4%)	**<0.001**
Invasive Diagnostic Procedure		948 (4.5%)	3,599 (9.6%)	**<0.001**	928 (3.6%)	3,693 (8.7%)	**<0.001**
Deceased		37 (0.2%)	403 (1.1%)	**<0.001**	352 (1.3%)	2,425 (5.7%)	**<0.001**
		Mean (SD)	**Mean (SD)**	**P**	**Mean (SD)**	**Mean (SD)**	**P**
Age, Years		50.45 (10.55)	49.15 (11.23)	**<0.001**	77.31 (7.70)	77.54 (7.67)	**<0.001**
Time to Invasive Diagnostic Procedure, Days		3.38 (2.71)	4.37 (6.91)	**<0.001**	3.58 (3.19)	5.51 (7.36)	0.090
Hospital Length of Stay, Days		3.73 (3.03)	10.26 (9.35)	**<0.001**	4.31 (3.38)	12.57 (8.87)	**<0.001**
Total Charges, Dollars		20,258 (20,517)	69,837 (87,144)	**<0.001**	22,648 (23,146)	87,849 (91,882)	**<0.001**

Table 4. Backward logistic regression analysis to evaluate the associations between mortality and different factors in emergently admitted adult patients with the primary diagnosis of intestinal or peritoneal adhesions with obstruction. Mortality was the dependent variable. NIS 2005-2014.

		Adults with Operation		**Adults with No Operation**	
		N = 33,272		**N = 21,114**	
		OR (95% CI)	**P**	**OR (95% CI)**	**P**
Time to Operation, Days		1.071 (1.051, 1.092)	**<0.001**	**N/A**	
Hospital Length of Stay, Days		**N/A**		1.093 (1.060, 1.126)	**<0.001**
Age, Years		1.063 (1.049, 1.077)	**<0.001**	1.099 (1.045, 1.157)	**<0.001**
Sex, Female		0.761 (0.615, 0.942)	**0.012**		
Income Quartile	**Quartile 4 [Ref]**		**<0.001**		
	Quartile 1	1.920 (1.412, 2.612)	**<0.001**		
	Quartile 2	1.701 (1.242, 2.331)	**0.001**		
	Quartile 3	1.002 (0.704, 1.425)	0.9		
Hospital Location	**Urban: Teaching [Ref]**		**0.018**		
	Rural	0.613 (0.402, 0.935)	**0.023**		
	Urban: Non-Teaching	1.131 (0.905, 1.413)	0.2		
Invasive Diagnostic Procedure		1.583 (1.177, 2.129)	**0.002**		
Race		**Removed Via Backward Elimination**			
Insurance					

Table 5. Backward logistic regression analysis to evaluate the associations between mortality and different factors in emergently admitted elderly patients with the primary diagnosis of intestinal or peritoneal adhesions with obstruction. Mortality was the dependent variable. NIS 2005-2014.

		Elderly with Operation		Elderly with No Operation	
		N = 34,535		N = 26,091	
		OR (95% CI)	P	OR (95% CI)	P
Time to Operation, Days		1.059 (1.046, 1.071)	**<0.001**	**N/A**	
Hospital Length of Stay, Days		**N/A**		1.050 (1.028, 1.072)	**<0.001**
Age, Years		1.077 (1.070, 1.084)	**<0.001**	1.108 (1.091, 1.124)	**<0.001**
Sex, Female		0.706 (0.643, 0.776)	**<0.001**	0.705 (0.568, 0.874)	**0.001**
Race	**White [Ref]**		**0.029**	**Removed Via Backward Elimination**	
	Black	1.252 (1.082, 1.450)	**0.003**		
	Hispanic	0.971 (0.774, 1.218)	0.8		
	Asian/Pacific Islander	1.223 (0.890, 1.680)	0.2		
	Native American	0.863 (0.348, 2.143)	0.7		
	Other	0.786 (0.523, 1.181)	0.2		
Income Quartile	**Quartile 4 [Ref]**		**0.003**		
	Quartile 1	1.273 (1.113, 1.455)	**<0.001**		
	Quartile 2	1.069 (0.935, 1.222)	0.3		
	Quartile 3	1.167 (1.024, 1.329)	**0.020**		
Invasive Diagnostic Procedure		1.282 (1.104, 1.488)	**0.001**		
Insurance		**Removed Via Backward Elimination**			
Hospital Location					

Table 6. Procedures of emergently admitted patients with the primary diagnosis of intestinal or peritoneal adhesions with obstruction. Data was stratified according to age groups (adults vs. elderly), outcome (survived vs. deceased) and surgery vs. invasive diagnostic procedures (NIS 2005-2014).

Surgical Procedure (ICD 9)	Adults, N (%)				Elderly, N (%)			
	Procedures	Survived	Deceased	P	Procedures	Survived	Deceased	P
Operations on Esophagus (42.01-42.19, 42.31-42.99)	44 (0.07%)	42 (95.5%)	2 (4.5%)	**0.043**	72 (0.1%)	63 (87.5%)	9 (12.5%)	**0.003**
Operations on Stomach (43.0-44.03, 44.21-44.99)	1,400 (2.4%)	1,358 (97.0%)	42 (3.0%)	**<0.001**	1,960 (2.9%)	1,728 (88.2%)	232 (11.8%)	**<0.001**
Operations on Intestine (45.00-45.03, 45.30-46.99)	14,058 (23.9%)	13,787 (98.1%)	271 (1.9%)	**<0.001**	18,209 (27.0%)	16,643 (91.4%)	1,566 (8.6%)	**<0.001**
Operations on Appendix (47.01-47.99)	3,144 (5.3%)	3,126 (99.4%)	18 (0.6%)	0.2	1,618 (2.4%)	1,551 (95.9%)	67 (4.1%)	0.8
Operations on Rectum, Rectosigmoid, and Perirectal Tissue (48.0-48.1, 48.31-48.99)	102 (0.2%)	100 (98.0%)	2 (2.0%)	0.1	118 (0.2%)	108 (91.5%)	10 (8.5%)	**0.015**
Operations on Anus (49.01-49.12, 49.31-49.99)	9 (0.02%)	9 (100%)	0 (0%)	0.9	12 (0.02%)	12 (100%)	0 (0%)	0.9
Operations on Liver (50.0, 50.21-50.99)	40 (0.07%)	39 (97.5%)	1 (2.5%)	0.2	44 (0.07%)	39 (88.6%)	5 (11.4%)	**0.014**
Operations on Gallbladder and Biliary Tract (51.01-51.04, 51.21-51.99)	664 (1.1%)	651 (98.0%)	13 (2.0%)	**<0.001**	981 (1.5%)	892 (90.9%)	89 (9.1%)	**<0.001**
Operations on Pancreas (52.01-52.09, 52.21-52.99)	16 (0.03%)	15 (93.8%)	1 (6.3%)	0.1	15 (0.02%)	12 (80.0%)	3 (20.0%)	**0.021**
Operations on Hernia (53.00-53.9)	3,156 (5.4%)	3,123 (99.0%)	33 (1.0%)	**0.047**	4,167 (6.2%)	3,934 (94.4%)	233 (5.6%)	**<0.001**
Operations on Other Operations on Abdominal Region (54.0-54.19, 54.3-54.99)	36,253 (61.6%)	35,871 (98.9%)	382 (1.1%)	**<0.001**	40,349 (59.7%)	38,059 (94.3%)	2,290 (5.7%)	**<0.001**

Invasive Diagnostic Procedure (ICD 9), N (%)	Procedures	Survived	Deceased	P	Procedures	Survived	Deceased	P
Invasive Diagnostic Procedure on Esophagus (42.21-42.29)	17 (0.4%)	16 (94.1%)	1 (5.9%)	0.1	18 (0.4%)	18 (100%)	0 (0%)	0.9
Invasive Diagnostic Procedure on Stomach (44.11-44.19)	46 (1.0%)	45 (97.8%)	1 (2.2%)	0.2	33 (0.7%)	30 (90.9%)	3 (9.1%)	0.1
Invasive Diagnostic Procedure on Intestine (45.11-45.29)	3,055 (64.0%)	3,013 (98.6%)	42 (1.4%)	**<0.001**	3,224 (66.8%)	3,039 (94.3%)	185 (5.7%)	**<0.001**
Invasive Diagnostic Procedure on Rectum, Rectosigmoid, and Perirectal Tissue (48.21-48.29)	202 (4.2%)	201 (99.5%)	1 (0.5%)	0.9	151 (3.1%)	143 (94.7%)	8 (5.3%)	0.4
Invasive Diagnostic Procedure on Anus (49.21-49.29)	11 (0.2%)	11 (100%)	0 (0%)	0.9	7 (0.1%)	6 (85.7%)	1 (14.3%)	0.2
Invasive Diagnostic Procedure on Liver (50.11-50.19)	184 (3.9%)	176 (95.7%)	8 (4.3%)	**<0.001**	175 (3.6%)	165 (94.3%)	10 (5.7%)	0.2
Invasive Diagnostic Procedure on Gallbladder and Biliary Tract (51.10-51.19)	15 (0.3%)	15 (100%)	0 (0%)	0.9	26 (0.5%)	25 (96.2%)	1 (3.8%)	0.9
Invasive Diagnostic Procedure on Pancreas (52.11-52.19)	10 (0.2%)	10 (100%)	0 (0%)	0.9	12 (0.2%)	11 (91.7%)	1 (8.3%)	0.3
Invasive Diagnostic Procedure on Other Operations on Abdominal Region (54.21-54.29)	1,234 (25.8%)	1,217 (98.6%)	17 (1.4%)	**0.010**	1,179 (24.4%)	1,092 (92.6%)	87 (7.4%)	**<0.001**