Evaluation of interfacility transfer patterns among emergency general surgery patients.

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Abstract

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Background

Interfacility transfer for emergency general surgery (EGS) is a key strategy for improving access to care. However, low-intensity transfers with short stays and without procedural intervention are linked to increased costs, poor patient and family experience, and poor resource allocation. Clinical and health system characteristics associated with low-intensity transfers among patients with EGS conditions remain unclear.

Methods

We performed a cohort study among adults with EGS conditions using the 2021 Healthcare Cost and Utilization Project State Inpatient and Emergency Department Databases from Florida and California. Lower-intensity transfers were defined as admissions ≤3 days with discharge to home without procedural intervention. We used multinomial logistic regression to identify patient and facility factors associated with lower-intensity transfers versus lower-intensity non-transfers.

Results

Of 211,466 patients presenting with EGS conditions, lower-intensity transfers encompassed 0.7% of encounters overall and 30% of transfers. Factors associated with lower-intensity transfer

versus non-transfer included Medicaid insurance, history of bariatric surgery, patients presenting to a critical access hospital, and patients presenting with cholecystitis. Patients presenting to hospitals with advanced gastroenterology and palliative care were less likely to undergo lower-intensity transfer than lower-intensity non-transfer ($p<0.05$ for all).

Discussion

Facility characteristics are associated with transfers among EGS patients with SSA and may be a future target for policy aimed at optimizing regional EGS care. Understanding clinical and resource needs of EGS patients may facilitate the development of interventions to support EGS care in resource-limited settings and triage patients requiring high-complexity care to tertiary and quaternary facilities.

BACKGROUND

Approximately 400,000 interfacility transfers occur every year for patients with emergency general surgery (EGS) conditions in the United States.[1,2] While transfers are a key strategy for facilitating access to surgical care, up to 50% of transfers for emergency general surgery result in short, non-operative hospital admissions and may be avoidable.[3–6] Transferred emergency general surgery patients generally experience higher morbidity, mortality, and healthcare resource utilization compared to their counterparts who are treated at index facilities, and transfers themselves are both financial and emotional stressors for patients and families.[2,7–10]

Despite their frequency and impact, little is known about factors that are associated with interfacility transfer and, more specifically, transfers that may have been unnecessary in emergency general surgery. Understanding these factors is critical as national efforts are underway aiming to promote access to quality emergency general surgery care.[11] Recent work attempting to characterize avoidable transfers in patients with emergency general surgery conditions have been unable to characterize both pre- and post-transfer care, and both index and receiving facility characteristics.[1,5,6,12,13] Others have limited their analyses to transfers resulting in inpatient stays, potentially missing a subpopulation of patients who transfer and are subsequently discharged from the emergency department.[3] Finally, nearly every study published about potentially avoidable transfers has only evaluated post-transfer patients, limiting the ability to distinguish a potentially avoidable transfer prior to the transfer occurring. To better support physicians caring for patients with emergency general surgery conditions, further work is needed to characterize patients who experience potentially avoidable transfers and the systems that care for them.

To address this problem, we aimed to identify sociodemographic, clinical, and hospital factors associated with short, non-operative hospital encounters after interfacility transfer for patients with emergency general surgery conditions. Our secondary aim was to identify factors associated with higher- versus lower-intensity hospital encounters for emergency general surgery, transfer versus non-transfer for emergency general surgery, and factors that were discordant between the two. Our work will serve to identify key populations and hospital resources that may be targeted to improve healthcare resource allocation in systems caring for patients with emergency general surgery conditions.

METHODS

Data Source

We used claims data from the 2021 Healthcare Cost and Utilization Project (HCUP) State Inpatient (IP) and State Emergency Department (ED) databases from Florida and California. These states were chosen because they offer patient identifiers that allow for tracking patients over time and identification of transfer episodes. Using linkage variables provided by HCUP, hospital data from the American Hospital Association Annual Survey and the Centers for Medicare and Medicaid Services were used to identify hospital characteristics.

This study was approved by the Institutional Review Board of the University of Washington (STUDY00016776).

Study Cohort and Covariates

All adult (≥18 years old) patients who presented acutely with an emergency general surgery condition were included. Episodes of care that were flagged as "elective" were excluded from analysis. Patients were identified by ICD-10 diagnosis codes for emergency general surgery conditions using previously published lists,[14] using only conditions that were flagged in HCUP as being "Present on Admission" to prevent inclusion of patients who developed emergency general surgery conditions while admitted for other reasons.

Sociodemographic and clinical characteristics included age (categorized into 18-39, 40-64, 65-79, and 80+ years old), sex, race/ethnicity, insurance payor type (private, Medicare, Medicaid, and other), and median household income quartile for the patient's ZIP code. Race and ethnicity data in HCUP are adopted from self-reported patient data recorded by hospitals; for the purposes of this study, we categorized these into non-Hispanic White, non-Hispanic Black, Hispanic, and non-Hispanic Other. Medical comorbidities were aggregated into binary indicators of lung disease, diabetes, cancer or immunosuppression, cardiovascular disease, and history of bariatric surgery using ICD-10 diagnosis codes that were "Present on Admission". Finally, the primary emergency general surgery diagnosis was included.

Hospital characteristics were identified through linkage of the HCUP databases to the American Hospital Association annual survey data and Centers for Medicare and Medicaid Services data. We used these data to identify whether hospitals had interventional radiology, palliative care services, and advanced gastroenterology (GI) capabilities (capable of endoscopic retrograde cholangiopancreatography). We also identified level 1 trauma centers, facilities in rural versus

urban environments, and facilities with ≥24 intensive care unit (ICU) beds, which was the median across all hospitals evaluated.

Primary Outcome

Our primary outcome was the patient's episode type, based on transfer status and intensity of care received after transfer (in the case of transfers) or at the index facility (in the case of non-transfers).

Encounters were first categorized as transfers versus non-transfers through use of the VisitLink and TimeToEvent variables provided by HCUP. All episodes of care within the year for a given patient were identified using the VisitLink identifier. Using the TimeToEvent and length of stay (LOS) variables, we then identified episodes of care where the discharge date from the index hospital occurred within 24 hours of the presentation to the receiving hospital. Similar methods have been previously used to identify transfer episodes using the HCUP State Inpatient and State ED databases.[3] We then categorized all transfers based on encounter types at the index and receiving hospitals, including ED-ED, ED-IP, IP-IP, and IP-ED transfers.

We then categorized episodes of care by intensity of care received. Encounters were considered lower-intensity if the total length of stay was ≤72 hours, no major therapeutic procedures were performed, and the patient was discharged to home. All other encounters were considered higher-intensity and included operative intervention, death, discharge to any location other than the patient's home (including skilled nursing facilities, hospice, long-term acute care facilities, etc.), or any length of stay >72 hours.

This allowed us to categorize each encounter into one of the following four mutually exclusive groups: lower-intensity transfer, lower-intensity non-transfer, higher-intensity transfer, and higher-intensity non-transfer.

Secondary Outcomes

As a secondary analysis, we evaluated factors associated with each component of the episode classification schema above: transfer versus non-transfer, and lower- versus higher-intensity episode of care. We hypothesized that factors associated with higher-intensity care would also be associated with higher likelihood of transfer; therefore, we established a matrix of our covariables based on likelihood of transfer versus non-transfer and higher- versus lower-intensity episode of care. We considered trends to be concordant if a factor was associated with both higher-intensity care and transfer, or if it was associated with both lower-intensity care and non-transfer. Factors were considered discordant if they were associated with either higher-intensity care and non-transfer, or lower-intensity care and transfer, as transfers ideally occur when a higher level of care is necessary presumably due to increased clinical needs. Possibly concordant factors were those with a significant trend toward either non-transfer/transfer or high/lower-intensity care, but not the other.

Statistical Analyses

To evaluate associations between our sociodemographic, clinical, and hospital covariables and each of our primary outcomes, we used a multivariable, multinomial logistic regression model with standard errors clustered by index hospital. We set our base outcome for multinomial

regression as lower-intensity non-transfers to allow for comparison of other outcome groups to patients who used relatively fewer facility resources and did not require transfer. We report estimated odds ratios (ORs) and 95% confidence intervals (CI) adjusted for age, sex, race and ethnicity, insurance payor type, income quartile, comorbidities, primary emergency general surgery diagnoses, and hospital characteristics as defined above. The same covariates were used to construct multivariable logistic regression models for our secondary outcomes, transfer versus non-transfer and high- versus lower-intensity care. We considered p-values under 0.05 to be statistically significant. All statistical analyses were performed using STATA version 18.0 (STATACorp, College Station, TX), with data visualization performed in R (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

We identified 211,466 patients presenting with emergency general surgery conditions, including 53.7% lower-intensity non-transfer, 0.7% lower-intensity transfer, 43.7% higher-intensity non-transfer, and 1.7% higher-intensity transfer. Notably, lower-intensity transfer encompassed 30.0% of transfers overall. Sociodemographic, clinical, and index hospital characteristics of our study population are presented in **Table 1**. Our study population was 51.5% female, 48.7% identified as non-Hispanic Black, Hispanic, or non-Hispanic Other race, and 20.6% were Medicaid-insured. Several characteristics differed substantially across outcome groups. Overall, there was a higher proportion of privately insured patients in the lower-intensity non-transfer group, higher proportions of rural patients in both transfer populations, and comorbid patients were more common in the higher-intensity care populations. Patients with intestinal obstruction encompassed larger proportions of the transfer populations, and those with appendicitis and

cholecystitis were more common in the higher-intensity non-transfer group. Facilities with advanced resources typically comprised smaller proportions of the transfer groups, while rural index facilities were more commonly involved in transfers.

Factors associated with lower-intensity transfer versus low-intensity non-transfer

Our primary aim was to identify factors associated with lower-intensity transfers compared with lower-intensity non-transfers that may represent cases where transfer was avoidable. Using multinomial logistic regression, we found that several sociodemographic factors were associated with an increased likelihood of lower-intensity transfer than lower-intensity non-transfer (**Table 2**). These included Medicaid insurance (OR 1.36, 95% CI 1.02-1.81 vs. private), history of bariatric surgery (OR 2.47, 95% CI 1.72-3.55 vs. no bariatric history), presentation to a critical access hospital (OR 3.00, 95% CI 1.32-6.82 vs. non-critical access hospital), and presentation with cholecystitis (OR 1.45, 95% CI 1.06-1.97 vs. appendicitis) or intestinal obstruction (OR 1.87, 95% CI 1.44-2.43 vs. appendicitis). Patients who presented to facilities with advanced gastroenterology and palliative care services were less likely to experience lower-intensity transfer versus lower-intensity non-transfer. Patients who were older, comorbid, and had cholecystitis and perforated peptic ulcer disease were more likely to require higher-intensity care with or without transfer (all $p<0.05$).

High- versus lower-intensity episodes of care and transfers versus admission

For our secondary aim, we evaluated factors associated with high- versus lower-intensity care encounters, with results in **Table 3.** Older, female, uninsured, and comorbid patients, those presenting with cholecystitis or perforated peptic ulcer disease, and those presenting to index

facilities that were level 1 Trauma Centers or had larger ICUs were more likely to experience higher-intensity episodes of care. Higher-intensity encounters were less likely among patients who were privately insured, presented with hernia, intestinal ischemia, intestinal obstruction, perirectal disease, or diverticulitis, and those presenting to facilities with interventional radiology and palliative care available (all $p<0.05$).

We also evaluated factors associated with transfer versus direct admission (**Table 4**). Patients with cancer or immunosuppression, those with a history of bariatric surgery, patients presenting with cholecystitis, intestinal ischemia, intestinal obstruction, or perforated peptic ulcer disease, and those presenting to Critical Access Hospitals were more likely to transfer. Patients were less likely to transfer if they were female, privately insured, uninsured, had a history of cardiovascular disease, presented with diverticulitis, or presented to hospitals with advanced GI, palliative care, or a large ICU available (all $p<0.05$).

Concordance between factors associated with transfer or higher-intensity encounters is shown in **Figure 1**. Patients with intestinal ischemia and intestinal obstruction at presentation were more likely to have a lower-intensity episode of care but were more likely to transfer. On the other hand, female patients, patients without insurance, patients with a history of cardiovascular disease, and those presenting initially to a hospital with a larger ICU were more likely to experience higher-intensity care but less likely to transfer.

DISCUSSION

In this cohort study of adult patients presenting with emergency general surgery conditions, we found that both patient and hospital factors likely play a role in ultimate patient disposition, including decisions about interfacility transfers. While lower-intensity transfers were rare overall, they represent close to one third of transfers for emergency general surgery conditions. Subpopulations with discordance between their likelihood of transfer and likelihood of higher-intensity care highlight potential opportunities for further study that may improve resource allocation across healthcare systems caring for patients with emergency general surgery conditions. These findings contribute to a growing body of literature suggesting that critical evaluation of transfer practices is necessary in the context of ongoing efforts to improve access to care in the United States.

Lower-intensity transfers encompassed 30% of all transfers among patients with emergency general surgery conditions. We found that patients with Medicaid insurance, those with a history of bariatric surgery, patients presenting with cholecystitis or intestinal obstruction, and patients presenting to critical access hospitals were more likely to undergo lower-intensity transfers. Previous studies have also found that a substantial proportion of emergency general surgery transfers do not result in prolonged hospitalization or operative intervention.[1,3,12,15] Importantly, we evaluated these transfers in the context of all patients presenting with emergency general surgery conditions – rather than solely among transferred patients. We therefore identified factors not only associated with lower-intensity transfers, but with higher-intensity transfers and non-transfer episodes of care. The elevated likelihood of lower-intensity transfer among patients with Medicaid raises a concern that these patients may receive differential treatment resulting from remuneration based on insurance payor. A previous study found that surgical patients with

unfavorable insurance payors or no insurance were more likely to be designated emergent in cases of interfacility transfer. However, this effect appeared to be driven by uninsured patients, as Medicaid insurance itself was not associated with emergency designation.[16] Additional work is needed to evaluate the interplay between insurance coverage, resource needs, and the use of interfacility transfer to provide all patients with access to care appropriate to their condition.

In addition to patient characteristics, we found that lower-intensity transfers were more likely among patients who initially presented to critical access hospitals. Teng et al. also found that critical access hospitals were associated with potentially avoidable transfer among patients with emergency general surgery conditions.[3] At the same time, after adjusting for other patient and hospital characteristics, presentation to a rural hospital was not associated with increased likelihood of lower-intensity transfer. Both critical access and rural facilities are capable of providing high-quality emergency general surgery care.[17] Evaluating the rationale behind interfacility transfers originating from critical access hospitals will be important in the future to identify patients appropriate for care at these facilities, particularly in cases where prolonged length of stay is unlikely. Nine percent of transfers in our study originated from critical access hospitals, indicating that these facilities play a substantial role within the triage landscape of emergency general surgery patient care. On the other hand, advanced GI and palliative care were associated with lower likelihood of lower-intensity transfer. This likely reflects that well-resourced facilities, and in particular those with key services that frequently collaborate with general surgeons in the care of emergency general surgery patients, may leverage these resources appropriately when determining whether to transfer patients.

When we evaluated factors associated with transfer versus admission and with high- versus lower-intensity care, we found that patients presenting with concern for intestinal ischemia or obstruction were likely to transfer but less likely to require higher-intensity care. This highlights a potential opportunity for future research in these populations to better assist clinical decision making and identify patients who are most likely to require surgical intervention or other advanced resources. While several studies have attempted to develop risk scores for patients with small bowel obstructions,[18] none are widely utilized in emergency departments in the US. Validation and use of prognostic tools are necessary to identify cases where local care may be appropriate for emergency general surgery patients generally; bowel obstruction and ischemia may be appropriate early targets. Beyond prognostication, these cases highlight the potential of telemedicine to more broadly support physicians caring for patients with emergency general surgery conditions. Telemedicine triage and support has been successfully implemented in trauma, burn surgery, and critical care,[19–23] but has not yet been widely adopted in emergency general surgery. Remote imaging review and consultation may facilitate improved identification of high- versus lower-risk emergency general surgery patients, empower physicians at index hospitals to care for patients for whom they are adequately resourced, and improve communication and coordination when transfer is deemed necessary.

In contrast, patients without insurance were less likely to transfer, but more likely to experience higher-intensity episodes of care. Patients with financial barriers to care may present with higher-complexity emergency general surgery disease,[24–28] potentially putting them at elevated risk for both operative intervention and prolonged hospitalization. The discordant trend in odds of transfer, even after accounting for hospital resources, indicates a potential disparity in facilitating

access to high-level care among patients without insurance, raising questions about whether this is indicative of bias. Previous studies investigating transfer among adults with emergency general surgery have demonstrated similar a tendency toward local care among uninsured patients.[13] While these studies have ascribed this finding to patients presenting with lower complexity disease, our findings suggest rather that uninsured patients my use *more* resources than their insured counterparts, raising important questions about financial barriers to care and the potential for variability based on non-clinical factors among transferring and accepting clinical teams.

Our study's findings should be interpreted in the context of its limitations. First, our findings are based on claims data, which in turn are dependent on accurate and reliable ICD-10 diagnostic and procedural coding. While this introduces the potential for misclassification of primary diagnosis or ultimate management, we attempted to address this by selecting a subset of all potential emergency general surgery patients that has been studied using claims data previously and clinically validated.[14] We performed multiple comparisons, which may yield some results that are statistically significant by chance; therefore, replication of these findings in other datasets would be important to confirm our findings. Transfer decision-making is complex and involves factors that are not measured or recorded systematically using administrative data sources. While additional study into factors that influence the decision to transfer among patients with emergency general surgery conditions, we provide an evaluation of large-scale trends in two populous, sociodemographically and geographically diverse states using widely available data. Additional factors likely contributing to transfer decision-making, including provider factors like experience and comfort, rationale for transfers, resource availability, and hospital capacity, must be systematically evaluated in the future to continue to support transfer utilization in this

population. Finally, we used data from the 2021 HCUP state databases because it was the most up-to-date data that facilitated identification of transfer episodes. At this time, the coronavirus pandemic was likely still impacting the healthcare system. While we do not anticipate that this would largely change the clinical decision making around transfer, it likely impacted some factors that were not available in our data. Therefore, future study should evaluate whether our findings are applicable not only to additional geographic regions, but also to the evolving post-pandemic healthcare system.

The findings of our study are important in the context of ongoing policy discussions aimed at providing access to care in surgical emergencies. The American College of Surgeons established an emergency general surgery Verification Program in 2022 which provides standards for hospital resources and data collection among facilities caring for patients with emergency general surgery conditions.[11] As this fledgling system becomes more widely adopted by emergency general surgery-capable facilities, it provides a unique opportunity to begin systematically tracking interfacility transfers and clinical outcomes among emergency general surgery patients in a more rigorous way. These data could facilitate ongoing quality improvement as emergency general surgery systems of care begin to mature. Preceding the establishment of this program, the Consolidated Appropriations Act of 2021 addressed increasing rural hospital closures by establishing the Rural Emergency Hospital system.[29,30] In this program, rural or critical access facilities fitting eligibility criteria will be allowed to close their inpatient units in exchange for additional funding support and Medicare and Medicaid payments. The impacts of the Rural Emergency Hospital system remain to be seen, but closure of inpatient units that currently provide emergency general surgery care may have unintended downstream effects

including increasing transfer volumes within emergency general surgery systems. Finally, as emergency general surgery care continues to become regionalized, policymakers must consider expansion of opportunities for cross-state telemedicine consultation, including consideration of national licensing for physicians. In the meantime, it is prudent for hospitals to invest resources in service lines, in particular advanced gastroenterology or palliative care, that may facilitate local care for more patients.

Overall, we found that several patient and hospital factors are associated with lower-intensity transfers, and that substantial discordance is present among patient populations where risk of high intensity care and transfer do not align. While further study is needed to understand the motivations for and barriers to transfer, our findings provide the first evaluation of resource utilization and transfer patterns across the spectrum of emergency general surgery care. By better understanding health system and patient factors that lead to interfacility transfers, we are one step closer to matching emergency general surgery patients to the resources they need – a critical step in right-sizing care and improving system resource use for this population.

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TABLES & FIGURES

Table 1. Sociodemographic, clinical, and hospital characteristics of episodes of care for emergency general surgery.

	Lower-Intensity Non-Transfer		Lower-Intensity Transfer		Higher-Intensity Non-Transfer		Higher-Intensity Transfer		Total
	N	%	N	%	N	%	N	%	N
Total	113,626	53.7	1,516	0.7	92,788	43.9	3,536	1.7	211,466
Age (years)									
18-39	16,641	14.6	252	16.6	13,673	14.7	435	12.3	31,001
40-64	58,231	51.2	787	51.9	40,596	43.8	1,465	41.4	101,079
65-79	26,783	23.6	322	21.2	24,814	26.7	1,064	30.1	52,983
≥80	11,971	10.5	155	10.2	13,705	14.8	572	16.2	26,403
Sex									
Male	57,837	50.9	777	51.3	42,294	45.6	1,622	45.9	102,530
Female	55,789	49.1	739	48.7	50,494	54.4	1,914	54.1	108,936
Payor									
Medicare	39,385	34.7	515	34.0	39,186	42.2	1,726	48.8	80,812
Medicaid	23,093	20.3	458	30.2	19,256	20.8	745	21.1	43,552
Private	43,078	37.9	472	31.1	27,598	29.8	909	25.7	72,057
Uninsured	5,180	4.6	43	2.8	4,370	4.7	90	2.5	9,683
Other	2,852	2.5	28	1.8	2,346	2.5	66	1.9	5,292
Comorbidities									
Lung Disease	11,223	9.9	108	7.1	13,686	14.7	496	14.0	25,513
Cardiovascular Disease	43,653	38.4	455	30.0	49,012	52.8	1,699	48.0	94,819
Diabetes	16,457	14.5	177	11.7	18,379	19.8	671	19.0	35,684
Cancer or Immuno-suppression	3,974	3.5	59	3.9	6,348	6.8	302	8.5	10,683
History of Bariatric Surgery	1,762	1.6	63	4.2	2,541	2.7	231	6.5	4,597
Primary Surgical Diagnosis									
Appendicitis	11,701	10.3	149	9.8	17,653	19.0	450	12.7	29,953
Cholecystitis	8,391	7.4	144	9.5	26,974	29.1	821	23.2	36,330
Hernia	27,332	24.1	384	25.3	11,622	12.5	493	13.9	39,831
Intestinal Ischemia	1,596	1.4	22	1.5	1,625	1.8	101	2.9	3,344
Intestinal Obstruction	25,079	22.1	549	36.2	22,402	24.1	1,197	33.9	49,227
Perirectal Disease	7,491	6.6	74	4.9	2,402	2.6	103	2.9	10,070

Perforated Peptic Ulcer Disease	155	0.1	0	0.0	1,460	1.6	71	2.0	1,686
Diverticulitis	31,881	28.1	194	12.8	8,650	9.3	300	8.5	41,025
Hospital Characteristics									
Advanced Gastroenterology Available	82,874	72.9	840	55.4	63,751	68.7	1,987	56.2	149,452
Interventional Radiology Available	77,564	68.3	791	52.2	56,544	60.9	1,799	50.9	136,698
Critical Access Hospital	1,786	1.6	155	10.2	907	1.0	301	8.5	3,149
Level 1 Trauma Center	7,284	6.4	60	4.0	7,650	8.2	212	6.0	15,206
Palliative Care Available	76,005	86.4	742	70.2	54,449	80.3	1,714	70.7	132,910
ICU Bed Size >24	74,283	65.4	907	59.8	64,915	70.0	2,174	61.5	142,279
Urban Location	92,175	81.1	1,183	78.0	78,338	84.4	2,790	78.9	174,486
Rural Location	21,451	18.9	333	22.0	14,450	15.6	746	21.1	36,980

ICU: Intensive care unit

Table 2. Odds ratios and confidence intervals for sociodemographic, clinical, and hospital factors associated with care intensity and transfer disposition among patients with EGS diagnoses.

Base Outcome - Lower-Intensity Non-Transfer	**Lower-Intensity Transfer**			**Higher-Intensity Non-Transfer**			**Higher-Intensity Transfer**		
	OR	95% CI		OR	95% CI		OR	95% CI	
Age (years)									
18-39	Ref			Ref			Ref		
40-64	1.00	0.83	1.20	1.17	1.12	1.22	1.08	0.93	1.25
65-79	0.79	0.59	1.06	1.30	1.19	1.42	1.09	0.86	1.37
≥80	0.87	0.62	1.22	1.58	1.43	1.75	1.30	1.01	1.67
Sex									
Male	Ref			Ref			Ref		
Female	0.95	0.83	1.07	1.07	1.04	1.10	0.96	0.88	1.05
Payor Type									
Medicare	Ref			Ref			Ref		
Medicaid	1.36	1.02	1.81	1.06	0.96	1.17	0.85	0.69	1.03
Private	0.69	0.54	0.90	0.79	0.72	0.87	0.55	0.46	0.66
Uninsured	0.65	0.45	0.94	1.24	1.11	1.38	0.63	0.47	0.84
Other	0.78	0.43	1.42	1.05	0.92	1.19	0.65	0.46	0.91
Comorbidities									
Lung Disease	0.70	0.56	0.89	1.36	1.27	1.44	1.23	1.08	1.39
Cardiovascular Disease	0.79	0.66	0.95	1.66	1.60	1.72	1.19	1.06	1.32
Diabetes	0.84	0.68	1.02	1.09	1.05	1.12	1.07	0.96	1.19
Cancer or Immunosuppression	1.04	0.76	1.43	2.01	1.86	2.16	2.33	2.02	2.69
History of Bariatric Surgery	2.47	1.72	3.55	1.75	1.61	1.91	4.16	3.37	5.15
Primary Surgical Diagnosis									
Appendicitis	Ref			Ref			Ref		
Cholecystitis	1.45	1.06	1.97	1.75	1.60	1.92	1.97	1.61	2.41
Hernia	1.09	0.82	1.44	0.23	0.20	0.26	0.35	0.27	0.44
Intestinal Ischemia	1.17	0.66	2.08	0.39	0.33	0.46	1.09	0.78	1.51
Intestinal Obstruction	1.87	1.44	2.43	0.41	0.36	0.47	0.82	0.66	1.02
Perirectal Disease	0.71	0.48	1.03	0.21	0.19	0.24	0.33	0.24	0.46

Perforated Peptic Ulcer Disease	0.00	0.00	0.00	4.45	3.62	5.47	8.37	5.43	12.91
Diverticulitis	0.55	0.39	0.77	0.15	0.13	0.17	0.19	0.15	0.25
Hospital Characteristics									
Advanced Gastroenterology Available	0.51	0.31	0.84	1.17	0.89	1.55	0.56	0.39	0.78
Interventional Radiology Available	0.88	0.57	1.35	0.71	0.59	0.85	0.70	0.54	0.92
Critical Access Hospital	3.00	1.32	6.82	0.80	0.52	1.24	2.43	1.12	5.28
Level 1 Trauma Center	0.71	0.45	1.11	1.48	1.22	1.80	1.29	0.95	1.76
Palliative Care Available	0.59	0.42	0.81	0.66	0.55	0.78	0.55	0.44	0.69
ICU Bed Size >24	0.84	0.65	1.09	1.23	1.04	1.46	0.80	0.66	0.98
Rural Location	1.12	0.82	1.52	0.80	0.65	0.99	1.07	0.80	1.43

Ref: reference group. ICU: intensive care unit.
Results from multinomial logistic regression with base outcome of lower-intensity non-transfer.

Table 3. Odds ratios and confidence intervals for sociodemographic, clinical, and hospital factors associated with care intensity among patients with EGS diagnoses.

	Higher-Intensity Care		
	OR	**95% CI**	
Age (years)			
18-39	Ref		
40-64	1.17	1.12	1.22
65-79	1.30	1.19	1.41
≥80	1.57	1.42	1.74
Sex			
Male	Ref		
Female	1.06	1.04	1.09
Payor Type			
Medicare	Ref		
Medicaid	1.04	0.95	1.15
Private	0.78	0.72	0.86
Uninsured	1.22	1.10	1.35
Other	1.03	0.91	1.17
Comorbidities			
Lung Disease	1.36	1.28	1.44
Cardiovascular Disease	1.65	1.59	1.71
Diabetes	1.09	1.05	1.12
Cancer or Immunosuppression	2.02	1.88	2.17
History of Bariatric Surgery	1.80	1.66	1.96
Primary Surgical Diagnosis			
Appendicitis	Ref		
Cholecystitis	1.75	1.60	1.92
Hernia	0.23	0.20	0.26
Intestinal Ischemia	0.41	0.35	0.48
Intestinal Obstruction	0.42	0.36	0.48
Perirectal Disease	0.22	0.19	0.24
Perforated Peptic Ulcer Disease	4.60	3.74	5.66
Diverticulitis	0.15	0.13	0.18
Hospital Characteristics			
Advanced Gastroenterology Available	1.14	0.88	1.48
Interventional Radiology Available	0.71	0.60	0.85
Critical Access Hospital	0.92	0.63	1.34
Level 1 Trauma Center	1.48	1.23	1.79
Palliative Care Available	0.66	0.56	0.78
ICU Bed Size >24	1.22	1.03	1.44
Rural Location	0.81	0.66	0.99

Ref: reference group. ICU: intensive care unit.

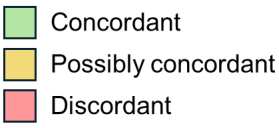
Table 4. Odds ratios and confidence intervals for sociodemographic, clinical, and hospital factors associated with transfer disposition among patients with EGS diagnoses.

	Transfer		
	OR	95% CI	
Age (years)			
18-39	Ref		
40-64	0.97	0.86	1.09
65-79	0.87	0.72	1.04
≥80	0.92	0.75	1.13
Sex			
Male	Ref		
Female	0.93	0.86	1.00
Payor Type			
Medicare	Ref		
Medicaid	0.97	0.81	1.15
Private	0.65	0.56	0.76
Uninsured	0.57	0.45	0.72
Other	0.67	0.48	0.93
Comorbidities			
Lung Disease	0.92	0.82	1.02
Cardiovascular Disease	0.83	0.75	0.91
Diabetes	0.96	0.88	1.06
Cancer or Immunosuppression	1.33	1.16	1.52
History of Bariatric Surgery	2.68	2.21	3.25
Primary Surgical Diagnosis			
Appendicitis	Ref		
Cholecystitis	1.25	1.06	1.47
Hernia	0.98	0.80	1.20
Intestinal Ischemia	1.90	1.45	2.49
Intestinal Obstruction	1.63	1.38	1.93
Perirectal Disease	0.79	0.60	1.04
Perforated Peptic Ulcer Disease	2.06	1.42	2.98
Diverticulitis	0.57	0.46	0.70
Hospital Characteristics			
Advanced Gastroenterology Available	0.50	0.33	0.75
Interventional Radiology Available	0.90	0.67	1.20
Critical Access Hospital	2.90	1.27	6.61
Level 1 Trauma Center	0.90	0.67	1.21
Palliative Care Available	0.69	0.55	0.87
ICU Bed Size >24	0.73	0.62	0.88
Rural Location	1.20	0.92	1.57

Ref: reference group. ICU: intensive care unit.

Figure 1. Factors associated with increased odds of transfer vs. non-transfer, and higher- versus lower-intensity care.

	Transfer Less Likely	**Transfer More Likely**	**No Trend in Transfer Likelihood**
Low-Intensity Care More Likely	Private Insurance Palliative Care Hernia Diverticulitis	Intestinal Ischemia Intestinal Obstruction	Interventional Radiology Perirectal Disease
High-Intensity Care More Likely	Female Uninsured Cardiovascular Disease ICU >24 Beds	Bariatric Surgery Cancer/Immunosuppression Cholecystitis Perforated Peptic Ulcer Disease	Older age (40-64, 65-79, ≥80) Lung Disease Diabetes Level 1 Trauma Center
No Trend in Intensity of Care	Other Insurance Advanced GI	Critical Access Hospital	Medicaid Rural Hospital



ICU: intensive care unit. GI: Gastroenterology.