ORIGINAL RESEARCH

The Relationship Between Off-Site Inpatient Gastroenterology Consultations and Timeliness of Care Delivery

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ABSTRACT

Introduction: Gastroenterologists are increasingly responsible for providing inpatient care at multiple facilities. Here, we hypothesized that a single gastroenterology team covering two facilities impacts care delivery outcomes such as length of stay (LOS).

Materials and Methods: This retrospective cohort study included inpatient GI consultations over a three-year period performed at two hospitals within a single academic health system. One site, where complete endoscopic services are provided, was considered the "primary," and the other a "satellite." These facilities are located approximately 10 minutes apart in walking time. Patients admitted to non-medical services were excluded. Outcomes included LOS, time from admission to consultation, use of inpatient endoscopy, and time from endoscopy to discharge.

Results: Of 1,952 admissions with GI consultation, 700 (36%) occurred at the satellite. The median LOS was longer for patients admitted to the satellite (4.9 vs. 4.2 days, $p<0.001$), primarily because there was a significantly longer time from admission to GI consultation (0.3 vs. 0.01 days, $p<0.001$); however, median time from consultation to discharge was similar between facilities ($p = 0.80$). Patients admitted to the primary facility were more likely to undergo inpatient endoscopy (62% vs. 55%, $p=0.003$). After adjusting for potential confounders, including consult indication, there was a significant positive correlation between admission to satellite and increased LOS (beta coefficient 3.72, $p<0.001$).

Conclusions: Inpatient GI consults at satellite facilities are associated with longer LOS and lower use of inpatient endoscopy. Health systems should monitor the timeliness of inpatient subspecialty care at satellites and consider interventions to minimize delays.

INTRODUCTION

Since 2008, there has been an increase in the number of system affiliated hospitals ("hospital networks") through the process of hospital mergers or acquisitions.[1] As a consequence, physicians are presumably more likely to provide inpatient consultative services and call coverage to patients admitted to several locations. Covering multiple hospitals simultaneously is associated with a higher likelihood of physician burnout.[2] Inpatient gastroenterology care is particularly nuanced given the need for consultation, follow-up care, and a spectrum of endoscopic diagnostics and therapies. The utilization of inpatient gastroenterology consults and inpatient endoscopic procedures have continued to increase over time.[3, 4]

As the landscape of healthcare systems continues to evolve, it is important to understand the impact of multi-site gastroenterology services on patient care. One potential effect of covering multiple facilities could be prolonged length of stay (LOS) related to delays in care delivery: from admission to consultation, use of endoscopy for diagnosis or treatment, and the concentration of consultative care during the hospitalization (i.e., frequency of follow-up encounters by the gastroenterologist throughout the hospitalization). We hypothesized that off-site gastroenterology consults would negatively impact care delivery by prolonging hospitalization. The aim of this study was to compare outcomes related to care delivery between patients receiving inpatient gastroenterology consultative care at the primary location for these consult services vs. an off-site facility. Outcomes evaluated included the following: overall LOS, time to completion of initial consultation, as well as use and timing of inpatient endoscopy.

MATERIALS AND METHODS

Study Population

The study was approved by the institutional review board prior to data procurement and analysis. This was a retrospective cohort study that included all patients admitted to a single academic, tertiary referral center and with the placement of an inpatient gastroenterology consult order placed via electronic medical record between January 1, 2016 and December 31, 2018.

Patients were excluded if they were admitted to a service other than internal medicine (including the intensive care unit at the time of consult placement) or if the same patient had been admitted with a gastroenterology consultation in the antecedent 12-month period. This criterion addressed a potential bias of repeat consultation on the timeliness of completing the encounter. All consultations for hepatology indications were also excluded. The rationale for limiting the study population to internal medicine was that the primary providers (hospitalists and house officers) cover internal medicine services at both facilities; therefore, the impact of individual medicine providers on study outcomes would be balanced between the two locations since they rotate through both facilities throughout the year and are familiar with clinical care processes at both facilities. Data were extracted from the electronic medical record (Epic, Verona, WI) after a search of the Institution's Clinical Data Warehouse, a web-based research management system.

Consults were categorized into the following groups based on the associated primary and secondary International Classification of Diseases, ninth revision (ICD-9): gastrointestinal bleeding (GIB), pancreatobiliary (PB), gastrointestinal symptoms, and nutrition/feeding tube placement. If a patient met criteria for more

than one of these indications, the primary indication was assigned using the following stratification:

1) GIB
2) PB
3) gastrointestinal symptoms
4) nutrition/feeding tube placement

Description of Facilities

The tertiary referral center comprises two inpatient locations. The primary facility is a 156-bed inpatient hospital which houses the inpatient units for the system's Digestive Disease Center and a mixed ambulatory/inpatient endoscopy unit for the health system; in addition, this facility is in greater proximity to the administrative offices for the gastroenterology group. The off-site (satellite) facility is a 709-bed inpatient medical center which is located approximately 10 minutes away in walking distance; there is no alternate method of non-patient transportation between the two facilities. This larger inpatient hospital does not contain dedicated space for GI administration or endoscopy. Therefore, inpatient consults require a dedicated trip to this facility to complete new and follow-up visits; when endoscopy is recommended, the patient is sent to the primary facility via ambulance for the procedure, recovered, and then returned to their inpatient room via ambulance transfer. The decision to admit a patient to one facility or the other is dependent upon bed availability, inpatient census on relevant services (in this case, internal medicine services), and the emergency room to which the patient presented.

Statistical Analysis

Statistical analysis was completed using Stata version 15 (College Station, TX). A p value <0.05 was considered statistically significant for the purpose of this study. Patient characteristics included demographics, type of health insurance,[5] and baseline comorbidity defined by the Charlson comorbidity index. Higher Charlson score (and other comorbidity indices) have been shown to correlate with longer LOS in numerous contexts.[6-8] Chi square, Fisher's exact, and Wilcoxon rank sum tests were used for comparative statistics of categorical and continuous variables, respectively.

Care delivery outcomes were defined as: 1) total LOS; 2) time from admission to completion of initial inpatient consult; 3) time from initial consult to endoscopy, if performed; 4) time from inpatient consult to discharge; 5) use of endoscopy (yes/no). LOS was calculated by the number of midnights in hospital (date of discharge – date of admission). Eligible inpatient consults were dichotomized by the location of hospitalization (primary or satellite facility). To identify characteristics associated with longer LOS, a linear regression model was constructed using variables having a p value < 0.10 by univariable analysis ($p < 0.10$); time sensitive variables were not considered for this model given their collinearity with total LOS.

A subgroup (n=300) of medical records was manually reviewed to assess data accuracy, particularly the correlation between ICD codes and the reason(s) for GI consult. In addition, and for this subgroup, the frequency of documented gastroenterology encounters (initial consult + follow-up daily progress notes) both before and after endoscopic intervention (when applicable) was measured as a quantitative metric for the intensity of GI consultative care.

RESULTS

During the study period, 5,653 encounters with a GI consultation were identified from the electronic data warehouse; 1,147 were excluded as duplicate records or

readmissions and 2,554 for admission to a non-medicine service or request for hepatology consultation. The remaining 1,952 unique hospitalizations were eligible for inclusion, including 700 from the satellite facility (***Figure 1***). Patients admitted to the primary facility were more likely to be female sex (51% vs. 43%, p=0.001), Black or African American (46% vs. 27%, p<0.001), and have Medicare/Medicaid health insurance (73% vs. 57%, p<0.001) ***(Table 1)***. Gastrointestinal bleeding was the most common indication for consultation at the satellite (47%), whereas pancreatobiliary consultations (38%) were most common at the primary facility. Baseline Charlson comorbidity score was similar for patients hospitalized at either the primary (5) or satellite (4) facility (p=0.12).

The median LOS was longer for patients admitted to the satellite facility (4.9 vs. 4.2 days, p<0.001) (***Table 2)***. When stratified by the primary indication for consultation, median LOS was significantly longer for patients with GI bleeding (p=0.013) and nutrition/feeding access issues (p=0.0009) hospitalized at the satellite facility. There was a significantly longer time from admission to GI consultation at the satellite facility (0.3 days vs. 0.01 days, p<0.001), whereas median time from consultation to discharge was similar between facilities (p=0.80). Patients admitted to the primary facility were more likely to undergo an endoscopic procedure during their hospitalization (62% vs. 55%, p=0.003); when stratified by the primary indication for GI consultation, those admitted for gastrointestinal bleeding at the primary facility were more likely to undergo endoscopy (69% vs. 62%, p = 0.046).

After manual medical record review of 300 randomly selected hospitalizations within this cohort, the accuracy of the electronic data capture for patient characteristics, indication for GI consultation, performance of endoscopy, and timing of admission, consultation, and discharge was excellent; there were no discrepancies in LOS, use of endoscopy, and categorization of indication for GI consult. For this subgroup, the number of documented inpatient GI follow-up visits after initial consultation (0.79 vs. 0.53, p=0.03) and endoscopy (0.48 vs. 0.26, p=0.005) was significantly greater for admissions at the primary facility.

Location of admission, indication for GI consult, race, sex, insurance type, and performance of endoscopy were incorporated into a multivariable linear regression model. This confirmed a significant positive correlation between admission to the satellite facility and LOS (correlation coefficient 3.72, p<0.001) ***(Table 3)***. Gastrointestinal bleeding and pancreatobiliary indications for GI consult were inversely correlated with LOS (-4.40 and -3.82, respectively). Sex, race category, and performance of endoscopy were not correlated with LOS. Inclusion of Charlson comorbidity index in this model did not change these observations (data not shown).

DISCUSSION

Although the two facilities we examined in this study are only 10 minutes walking distance apart, we observed significantly longer LOS even after adjusting for potential confounding factors. Based on differences in time between admission, consultation, performance of endoscopy, and discharge following consultation, the principal time factor associated with this delay appeared to be the time from admission to consultation (0.01 vs. 0.3 days, or 0.2 vs. 7.2 hours, p<0.001). GI bleeding and pancreatobiliary indications for GI consultation were inversely associated with LOS, suggesting these indications prompt shorter times from admission to consultation than GI symptoms

or nutrition concerns; however, even after adjusting for the consult indication, admission site persisted as an independent factor associated with greater LOS. This translates into a difference roughly equivalent to a workday, thus having a significant impact on LOS. This delay impacts the number of overnight inpatient days, reduced inpatient throughput, and greater overall costs of inpatient care. Nevertheless, it is logical to infer that greater geographical separation between facilities – i.e., the specialist having to drive across town to staff inpatient consults – could exacerbate the LOS differences observed in our practice.

An important potential factor that may contribute to an increased LOS is the intensity with which GI consultants follow patients after completing the initial evaluation. Despite having more time to complete follow-up visits on patients admitted to the satellite facility (given their longer LOS), the mean number of documented GI encounters was significantly lower. We speculate that factors contributing to this difference include the inconvenience of traveling to the satellite facility and inability to evaluate these patients on an ad hoc basis throughout the workday (e.g., between endoscopies). It is unlikely that the indication for the consult influenced these differences, which persisted across consult indications. Still, the time from completion of the GI consult to discharge did not differ between facilities.

Use of telemedicine could mitigate some of the challenges with providing subspecialty inpatient care at satellite facilities. Telemedicine has the potential to reduce cost, increase patient satisfaction, and improve management of chronic medical conditions. Use of telemedicine in Veterans Administration patients with diabetes mellitus has been shown to improve appointment adherence, high satisfaction, and cost reduction; a majority of cost savings was from decrease in travel reimbursements.[9] Patients treated for hepatitis C experienced similar rates of sustained viral response whether treated in person or via telemedicine.[10] Telemedicine improves the quality of bowel prep (82% vs. 70%) before screening colonoscopy, thereby improving adenoma detection rate.[11] The use of telemedicine has also been used in the intensive care unit, reducing intensive care LOS and both intensive care and in-hospital mortality.[12] The use of telemedicine will likely continue to increase due to patient increased satisfaction and convenience of care delivery to patients in more remote geographical areas.

This study is limited by its retrospective design and inclusion of one academic health care system with an "on-campus" location of its satellite facility. Inpatient gastroenterology care in an academic model is unique since it incorporates trainee physicians and medical students in the workflow; these individuals often serve as physician extenders by evaluating patients in advance of the attending provider. Patient satisfaction and various outcomes have been shown to be different between teaching and nonteaching hospitals. Prior studies have shown that major teaching hospitals have lower 30-day unadjusted mortality rates for common medical conditions in comparison to nonteaching hospitals (8.1% vs. 9.6%).[13] Despite often having worse outcomes, nonteaching hospitals surprisingly scored higher in nearly every category of the Hospital Consumer Assessment of Healthcare Providers and Systems survey.[14] This could be related to different patient expectations or more complex care coordination at academic centers. The impact of off-site subspecialty care should be evaluated in health systems spanning larger distances and consider the impact of on-site advanced practice providers on the efficiency

of care delivery. The impact on LOS may be exacerbated in systems with multiple satellite facilities separated by larger distances (e.g., those requiring a consultant to drive between multiple facilities).

In summary, patients admitted to an "off-site" facility at an academic medical center who required gastroenterology consultation had prolonged LOS, even when this facility was within walking distance of the primary location. Interventions that could mitigate this impact include the use of telemedicine services and additional on-site practitioners. When on-site specialty services cannot be provided at each hospital within a health system network, patients could be admitted directly from urgent care centers or ambulatory clinics to the facilities best equipped to provide the most efficient specialty care. With greater awareness and tracking of these efficiency metrics across health systems, quality improvement initiatives could then be designed to minimize LOS while optimizing patient outcomes.

Notes

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Figure 1. Study Inclusion and Exclusion Criteria

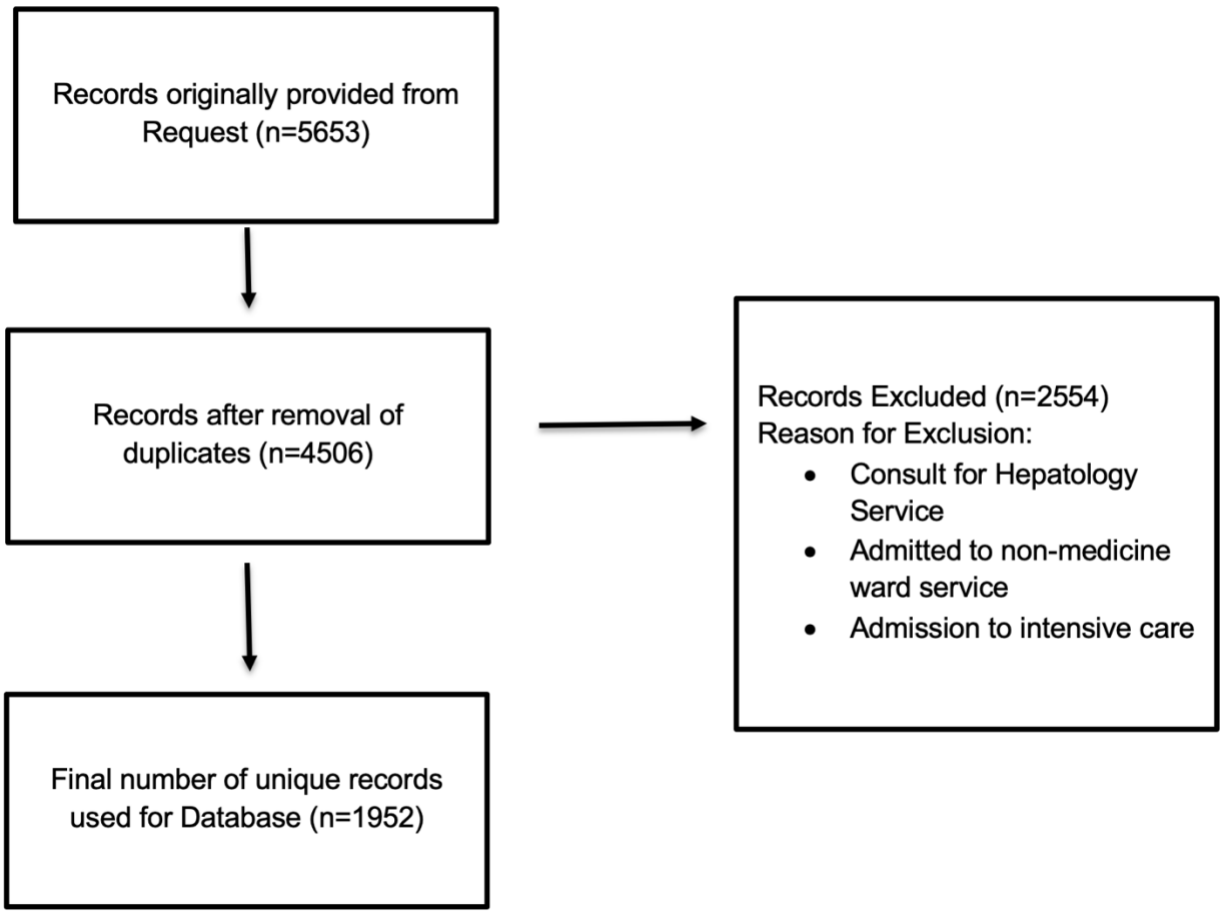

Table 1. Patient Characteristics

	Primary Location (n=1252)	Satellite Location (n=700)	P value
Median age (interquartile range)	61 (47-71)	60 (46-71)	0.123
Sex (% female)	641 (51.2%)	304 (43.4%)	0.001
Race category			
• White	646 (51.6%)	479 (68.8%)	<0.001
• Black or African American	569 (45.5%)	185 (26.6%)	
• Asian	10 (0.8%)	6 (0.9%)	
• American Indian or Alaska Native	2 (0.2%)	2 (0.3%)	
• Other	24 (1.9%)	24 (3.5%)	
Insurance Type			
• Commercial	217 (17.4%)	183 (26.4%)	<0.001
• Medicare/Medicaid	913 (73%)	395 (56.9%)	
• Managed Care	47 (3.8%)	55 (7.9%)	
• Self-Pay	74 (5.9%)	61 (8.8%)	
Charlson Comorbidity Index	5 (2-9)	4 (2-8)	0.12
Indication for Consult			
• Gastrointestinal bleeding	429 (34.4%)	330 (47.1%)	0.001
• Gastrointestinal symptoms	281 (22.0%)	174 (24.9%)	
• Pancreatobiliary	474 (38.0%)	125 (17.9%)	
• Nutrition	65 (5.2%)	71 (10.1%)	

Table 2: Care Delivery

Variable	Primary Location	Satellite Location	P value
LOS, median (interquartile range)	4.2 (2.5-7.7)	4.9 (2.6-9.8)	<0.001
• Gastrointestinal bleeding	3.5 (2.2-5.8)	3.9 (2.2-8.5)	0.013
• Gastrointestinal symptoms	4.8 (2.6-9.8)	5.4 (2.9-11.0)	0.25
• Pancreatobiliary	4.6 (2.6-7.8)	4.7 (2.7-6.7)	0.83
• Nutrition	5.9 (3.8-10.9)	10.5 (5.7-24.4)	0.0009
Performance of endoscopy, n (%)	775 (61.9)	385 (55.0)	0.003
• Gastrointestinal bleeding	294 (68.5)	203 (61.5)	0.046
• Gastrointestinal symptoms	129 (45.9)	66 (37.9)	0.10
• Pancreatobiliary	305 (64.4)	71 (56.8)	0.15
• Nutrition	47 (72.3)	45 (63.4)	0.28
Time from admission to GI consult, days	0.01 (0-0.4)	0.3 (0-1.9)	<0.001
Time from GI consult to discharge, days	3.9 (2.3-6.8)	4.0 (2.2-7.3)	0.80
Time from GI consult order to endoscopy, days	1.03 (0.73-1.98)	1.14 (0.80-2.25)	0.21
Number of GI follow-up notes after initial consult, mean (SD)	0.79 (1.22)	0.53 (1.13)	0.028
Number of GI follow-up notes after endoscopy, mean (SD)	0.48 (0.86)	0.26 (0.94)	0.038

Table 3. Linear regression model of factors associated with prolonged length of stay

Variable	Coefficient (95% confidence interval)	P value
Admission to satellite facility	3.72 (1.91, 5.52)	< 0.001
Indication for GI consult		
• GI symptoms	Reference	
• Pancreatobiliary	-3.82 (-6.12, -1.53)	0.001
• Nutrition	2.40 (-1.18, 5.99)	0.189
• GI bleeding	-4.40 (-6.59, -2.22)	< 0.001
Race category		
• White	Reference	
• Black or African American	-0.11 (-1.87, 1.63)	0.89
• Asian	-3.46 (-12.56, 5.64)	0.46
• American Indian or Alaskan Native	2.86 (-15.23, 20.95)	0.76
• Other	-0.28 (-5.67, 5.11)	0.92
Male sex	0.11 (-1.55, 1.76)	0.90
Performance of endoscopy	0.46 (-1.25, 2.16)	0.53
Insurance type		
• Commercial	Reference	
• Medicare/Medicaid	0.84 (-1.27, 2.94)	0.78
• Managed care	0.66 (-3.36, 4.67)	0.75
• Self-pay	-1.36 (-5.00, 2.28)	0.46

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