Predictive Factors of Discharge Navigation Lag Time

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ABSTRACT

OBJECTIVES: The purpose of this study was to examine the factors associated with discharge lag time and how lag time relates to the discharge process.

STUDY DESIGN: Delays in patient discharge have major implications for patient bed allocation and hospital throughput. Discharge lag time is a metric that can be used to monitor discharge efficiency.

METHODS: This was a retrospective review of all patients undergoing colorectal surgery who were discharged from a tertiary care facility between January 1, 2007, and May 21, 2014. The effects of various factors were examined using χ^2 tests for categorical data and 2-sample *t* tests for continuous data. Any factor that had a P value <.20 on univariate analysis was incorporated into the multivariate ordinal logistic model.

RESULTS: During the study period, 1707 patients were discharged. Factors that were found to correlate with a longer discharge time using univariate analysis (P <.05) were gender, primary diagnosis of cancer, type of surgical procedure, time the order was written, use of a discharge navigator, and discharge destination. Day of the week did not meet statistical significance on univariate analysis, but was included in the multivariate analysis. Upon multivariate analysis, the only factors that correlated with a longer lag time were gender (P = .012), day of the week that the discharge occurred (P = .033), time the order was written (P <.001), use of a discharge navigator (P = .012), and discharge destination (P = .045).

CONCLUSIONS: Discharge orders placed earlier in the morning cause an increase in lag time and a backlog of patient discharges. It is important for hospitals to have adequate personnel to handle these early discharges.

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With healthcare spending continuing to increase while reimbursements are becoming more regulated and fixed, many healthcare systems have begun looking at ways to reduce costs.[1] Efficient hospital discharge is one component of a strategy to decrease healthcare spending.

Delays in discharge not only increase the cost of the hospitalization for the patient and the facility, but they also decrease hospital revenue by occupying beds that could go to other patients.[2,3] Discharge delays also affect patient satisfaction, because other patients remain in the emergency department or postanesthesia care unit for extended times, and can hinder patient care by preventing prompt transfers to tertiary care facilities. Reasons for delays in discharge and increased length of stay for seemingly unnecessary reasons have been well studied. The problem is multifactorial and usually due to poor coordination of care and lack of communication,[4-9] which are issues that could be remedied with personnel dedicated to the discharge process.

The use of discharge navigators, coordinators, and/or planners has been increasing in an effort to help streamline the transition to posthospital care.[10] Discharge navigators have been shown to be effective at increasing patient satisfaction with the discharge process and are more likely to have discharge documentation, follow-up, and prescriptions prescribed and filled earlier, while alleviating some of the burden carried by the patient's medical team.[11] These discharge navigators act as a major component of the continuum of care between the inpatient and outpatient settings.[12,13]

Discharge lag time, the time from discharge order entry to actual patient exit from the hospital, is one metric used to quantify discharge efficiency. The ability to better understand this variable will allow hospitals to plan for bed allocation. The goal of this study was to examine discharge lag times for patients undergoing colorectal operations and examine factors that increase or decrease these times.

METHODS

This study was a retrospective review of all patients 18 years or older undergoing major colorectal surgery who were discharged from Geisinger Medical Center (GMC) in Danville, Pennsylvania, between January 1, 2007, and May 21, 2014. This study was reviewed and approved by the GMC institutional review board.

The primary outcome of the study was discharge lag time, which was defined as the interval between when the discharge order was written and the patient's departure from the hospital. Discharge lag time was categorized in 3 groups: less than 2 hours, 2 to 4 hours, and more than 4 hours.

The discharge navigator is a physician extender who meets with the surgical team early in the morning to get the plan for patients about their possible discharge and what needs to be done in order to get the patient out of the hospital. These individuals work closely with the surgical team, patient, and care manager to facilitate each patient's discharge. They place the order for discharge, schedule follow-up appointments, handle wound and drain care education, and provide prescriptions for medications upon discharge. They are only employed Monday through Friday; therefore, all discharges occurring during the weekend are the responsibility of the physician.

Patient, perioperative, and peridischarge variables were used to test associations among the variables and discharge lag times. Patient characteristics such as age, gender, body mass index (BMI), Charlson Comorbidity Index (CCI) score, and distance from hospital (using great-circle distance calculation from the patient's home zip code to the hospital) were captured. Surgical characteristics such as primary diagnosis, procedure, approach, and duration of surgery also were collected. The discharge characteristics collected were day of discharge (eg, day of the week), time the order was written, presence of a discharge navigator, number of days since surgery (postoperative day), and discharge destination. Data were retrospectively collected from the electronic health record and the institution's comprehensive enterprise-level data warehouse.

Statistical Analysis

The characteristics of the study population were described using mean ± standard deviation for continuous data, median (interquartile range) for nonparametric data, and frequency (percentage) for categorical data. Ordinal logistic regression was used to test the association of each variable with discharge lag time, and data were represented as odds ratios (ORs) and 95% CIs. Any variable with a P value <.20 on univariate analysis was incorporated into a multivariate ordinal logistic model. All significance testing was 2-sided, with α set at 0.05. Analyses were performed using SAS 9.4 (SAS Institute; Cary, North Carolina).

RESULTS

A total of 1707 patients met inclusion criteria; a breakdown of the demographics of the population can be seen in **Table 1**. Of these, 746 patients had a discharge lag time of less than 2 hours, 612 had a discharge lag time between 2 and 4 hours, and 349 patients had a discharge lag time longer than 4 hours.

Univariate Analysis

Patient, perioperative, and peridischarge variables used to test associations among the variables and discharge lag times are shown in **Table 2**. The mean patient age was 61.4 years, which was not associated with discharge lag time (OR, 1.004; 95% CI, 0.998-1.009). The mean BMI was 29.6, which was not associated with delays in discharge (OR, 1.006; 95% CI, 0.994-1.018). Female patients (51.9%) had significantly longer lag times (OR, 1.224; 95% CI, 1.025-1.461) than male patients. The median CCI score was 2 and was not associated with discharge lag time (OR, 0.999; 95% CI, 0.961-1.040). The median distance patients lived from the hospital was 21.5 miles and was not associated with discharge efficiency (OR, 1.003; 95% CI, 0.996-1.010).

Patients with colon or rectal cancer (39.2%) had significantly longer lag times (OR, 1.294; 95% CI, 1.079-1.551) compared with patients who were undergoing surgery for a noncancer-related reason. Patients who had undergone colon resection (67.1%) were found to have shorter lag times compared with those who had undergone rectal resection (OR, 0.826; 95% CI, 0.658-0.997). Surgical duration and approach were not associated with discharge efficiency.

The median postoperative day discharge was 5 days and was not associated with lag time (OR, 0.997; 95% CI, 0.985-1.009). The majority of patients were discharged to their home (76.2%), followed by a skilled nursing facility (SNF) (19.2%) and other (eg, prison, long-term acute care hospital, nursing home, death) (4.6%), which showed a difference in lag time among the 3 groups in that patients discharged to their home had a shorter discharge lag time.

The majority of discharge orders were written before 11 AM (51.9%), which was found to be associated with a significant increase in lag time (OR, 9.789; 95% CI, 7.313-13.103) compared with orders placed after 2 PM. Orders written by a discharge navigator (24%) also increased lag times (OR, 1.798; 95% CI, 1.462-2.212) compared with discharge orders written by a physician. The day of the week (including weekends) was not associated with a delay in discharge.

Table 1. Demographics of Patients, 2007-2014

Variable	Total (N = 1707)
Age, years, mean ± SD	61.4 ± 15.6
Gender, n (%)	
Male	822 (48.2%)
Female	885 (51.9%)
Body mass index, mean ± SD	29.6 ± 7.6
Charlson Comorbidity Index score, mean (range)	2 (0-3)
Great-circle distance, 10-mile increase, mean (range)	21.5 (12.7-45.6)
Surgical duration, 15-minute increase, mean ± SD	174.0 ± 79.1
Primary diagnosis of cancer, n (%)	669 (39.2%)
Surgical procedure, n (%)	
Colon resection	1146 (67.1%)
Rectal resection	561 (32.9%)
Approach, n (%)	
Laparoscopic	715 (41.9%)
Open	992 (58.1%)
Day of discharge, n (%)	
Monday	260 (15.2%)
Tuesday	235 (13.8%)
Wednesday	263 (15.4%)
Thursday	344 (20.2%)
Friday	303 (17.8%)
Saturday	176 (10.3%)
Sunday	126 (7.4%)
Time order was written, n (%)	
Before 11 AM	886 (51.9%)
11 AM - 2 PM	500 (29.3%)
After 2 PM	321 (18.8%)
Discharge navigator, n (%)	409 (24%)
Postoperative day, mean (range)	5 (3-9)
Discharge destination, n (%)	
Home	1301 (76.2%)
Skilled nursing facility	327 (19.2%)
Other	79 (4.6%)

Multivariate Analysis

Next, a multivariate analysis was performed; results are shown in Table 3. Female patients were again found to have longer discharge lag times (OR, 1.272; 95% CI, 1.054-1.535) than males. Primary diagnosis of cancer and type of resection were no longer associated with lag time; however, day of the week was significantly associated with lag time (P = .03). Discharge orders written before 11 AM had significantly longer lag times compared with orders written after 2 PM (OR, 9.845; 95% CI, 7.283-13.309). Patients discharged to their home had shorter lag times than those who were discharged to SNFs (OR, 0.738; 95% CI, 0.580-0.939).

DISCUSSION

Similar to the findings of prior research regarding the discharge process, the results of this study also indicate that delays in discharge are multifactorial. Women had longer discharge lag times, as did patients discharged to SNFs. The hour at which the discharge order was written had a significant effect on discharge efficiency, with earlier orders associated with longer lag times.

Findings of a study by Bozorghadad et al had demonstrated that the use of discharge navigators allowed for earlier discharge from the hospital.[14] However, that study did not specifically look at lag time. Interestingly, our study revealed that discharge navigators increase lag time. One can theorize that the effect of the discharge navigator and the time of the order entry are interrelated. Increased efficiency of the discharge navigator in order entry may be creating a backlog of patients and thereby creating a backlog of work for nursing to get these patients discharged. The most important finding of this study is that the lag time was highest when discharge orders were written before 11 AM. This is most likely due to the fact that the highest number of discharges were taking place in that time period. This phenomenon can be remedied by adding personnel during these hours. With this additional support, hospitals can achieve the goals of early discharge and shorter lag time.

Discharge destination was found to be statistically different in terms of lag time on both univariate and multivariate analysis. Discharge to home had the shortest lag time, whereas being discharged to a SNF increased this time. This could be due to poor communication and coordination with the receiving facility and/or issues with coordination of transportation services. In addition, bed availability at the receiving institution can affect lag time. Transportation is a factor that, in many cases, is beyond the hospital's control. However, better control of transportation in the future could improve discharge efficiency.

CONCLUSIONS

Hospital discharge efficiency is multifactorial and often influenced by factors beyond the hospital's control. Elements of the discharge process, such as discharge navigators, which improve certain aspects of the discharge process (ie, time of day that orders are written; earlier-in-the-day discharge), can disrupt other aspects (discharge lag time). To achieve a more efficient process, it is necessary for hospitals to have an appropriate number of staff to deal with these earlier discharges to allow beds to be free for incoming patients.

Table 2. Univariate Analysis of Perioperative and Peridischarge Variables

Variable	OR	95% CI	*P* [a]
Age	1.004	0.998-1.009	.23
Gender			**.03**
Male	Ref	Ref	
Female	1.224	1.025-1.461	
Body mass index	1.006	0.994-1.018	.32
Charlson Comorbidity Index score	0.999	0.961-1.040	.94
Great-circle distance, 10-mile increase	1.003	0.996-1.010	.46
Surgical duration, 15-minute increase	1.007	0.990-1.024	.45
Primary diagnosis of cancer	1.294	1.079-1.551	**.01**
Surgical procedure			**.05**
Colon resection	0.826	0.658-0.997	
Rectal resection	Ref	Ref	
Approach			.27
Laparoscopic	0.903	0.754-1.081	
Open	Ref	Ref	
Day of discharge			.08
Monday	0.889	0.647-1.247	
Tuesday	Ref	Ref	
Wednesday	0.802	0.578-1.114	
Thursday	0.719	0.528-0.981	
Friday	1.089	0.794-1.493	
Saturday	0.850	0.591-1.223	
Sunday	0.712	0.474-1.069	
Time order was written			**<.0001**
Before 11 AM	9.789	7.313-13.103	
11 AM - 2 PM	2.652	1.949-3.609	
After 2 PM	Ref	Ref	
Discharge navigator	1.798	1.462-2.212	**<.0001**
Postoperative day	0.997	0.985-1.009	.59
Discharge destination			**.01**
Home	0.813	0.649-1.018	
SNF	Ref	Ref	
Other	0.481	0.299-0.774	

OR indicates odds ratio; ref, reference; SNF, skilled nursing facility.
[a]**Bold** indicates significance (at $P \leq .05$ level).

Table 3. Multivariate Analysis of Perioperative and Peridischarge Variables[a]

Variable	OR	95% CI	*P* [b]
Female	1.272	1.054-1.535	**.01**
Primary diagnosis of cancer	1.170	0.966-1.418	.11
Colon resection	0.973	0.794-1.192	.79
Day of the week			**.03**
Monday	1.015	0.719-1.433	
Tuesday	Ref	Ref	
Wednesday	0.902	0.639-1.274	
Thursday	0.692	0.500-0.960	
Friday	1.023	0.735-1.425	
Saturday	0.715	0.484-1.055	
Sunday	0.626	0.405-0.969	
Time order was written			**<.0001**
Before 11 AM	3.865	3.093-4.829	
11 AM - 2 PM	Ref	Ref	
After 2 PM	0.393	0.287-0.536	
Discharge navigator	1.340	1.067-1.683	**.01**
Discharge destination			**.04**
Home	0.738	0.580-0.939	
SNF	Ref	Ref	
Other	0.851	0.512-1.414	

OR indicates odds ratio; ref, reference; SNF, skilled nursing facility.
[a]Values included in the multivariate analysis had a *P* value <.2 in univariate analysis.
[b]**Bold** indicates significance (at $P \leq .05$ level).

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