



Contents lists available at ScienceDirect

The American Journal of Surgery

journal homepage: www.americanjournalofsurgery.com

Failure of efforts to contain costs of care after colorectal procedures: Nationwide trends in length of stay, costs and post-acute care utilization

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ARTICLE INFO

Article history:

Received 15 December 2016
Received in revised form
15 March 2017
Accepted 31 March 2017

Keywords:

Colorectal surgery
Costs
Post-acute care
Resource utilization
Trends

ABSTRACT

Background: This study aims to report trends in healthcare resource utilization and costs after colorectal surgery in the US.

Methods: From all-payer inpatient data, patients who were discharged after elective colorectal procedures (2002–2011) were identified. Trends in postoperative hospital stay, costs and post-acute care were evaluated.

Results: Of 251,583 included patients, median length of stay was 6 days. Trends over time suggested a progressive reduction in hospital stay after surgery until 2008 after which there was an increase (6.6 days in 2002, 5.9 days in 2008 and 6.1 days in 2010). Costs (peak:2011, \$51,731) and post-acute care (peak:2011, 19.4%) continued to increase throughout.

Conclusions: While length of stay over the last decade reduced, a further reduction may not be feasible. Meanwhile, inpatient costs as well as the use of post-acute care programs have continued to rise. Healthcare planning needs to focus on patients who cannot be discharged early, and more comprehensively evaluate the interplay between length of stay, readmissions, inpatient and post-acute care utilization if we are to contain overall healthcare costs.

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1. Introduction

There is currently a major impetus on minimizing hospital stay by early discharge so as to improve outcomes and save resources.^{1–3} Previous literature has demonstrated the beneficial impact of early discharge after colorectal surgery^{4,5} with fewer emergency room visits or readmissions,^{6,7} without influencing major complications.⁸ The Enhanced Recovery Program (ERP) was introduced to optimize physiological as well as psychological patient functioning in order to facilitate postoperative recovery, thus shortening inpatient stay after surgery.^{2,4,9,10} Several obstacles to the adoption of fast-track pathways exist,^{3,11} with concerns for the

safety of early discharge and the recent public monitoring and reporting of readmissions being such barriers.

The literature lacks clarity as to whether the length of stay has in fact reduced after colorectal surgery and in particular, whether any reduction in stay achieved is associated with a consequent increase in the use of post-acute care services since this would translate into an increase in overall costs for the health system despite reduced costs for the hospital. Using data from the National Inpatient Sample (NIS), this study evaluates nationwide trends in length of stay, discharge within 72 h, costs and post-acute care use after major colorectal procedures.

2. Methods

The Healthcare Cost and Utilization Project, National Inpatient Sample (HCUP) (NIS) is the largest all-payer national inpatient dataset and is sponsored by the Agency for Healthcare Research and Quality. The NIS provides data on 8 million admissions per year,

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from a 20% stratified sample of community hospitals (1000 acute-care hospitals) in the United States and has been redesigned recently.¹² Adult patients who were discharged alive after elective primary open or laparoscopic colorectal procedures (*International Classification of Diseases, Ninth Edition, Clinical Modification* procedural codes: 17.31, 17.32, 17.33, 17.34, 17.35, 17.36, 17.39, 45.71, 45.72, 45.73, 45.74, 45.76, 45.79, 45.81, 45.82, 45.95, 48.40, 48.42, 48.43, 48.49, 48.50, 48.51, 48.52, 48.59, 48.61, 48.62, 48.63, 48.64, 48.65, 48.69) between 2002 and 2011 were identified (n = 315,126). Those discharged with non-colorectal primary diagnosis (n = 28,309) or who had missing or inconsistent data on length of stay (n = 35,234) were excluded. By subtracting the duration between admission and primary procedure from the total length of hospital stay, the postoperative day of discharge was identified for each case. Trends in the postoperative length of stay, adoption of early discharge, inpatient expenses and post-acute care were evaluated.

Previous literature demonstrated hospital stay of 0–3 days after surgery to exceed fifty percent with comprehensive multidisciplinary protocols.^{4,5} Further, patients managed under the ERP were more likely to be discharged in 72 h postoperatively, as compared to conventional treatment.⁷ Based on this, we sought to additionally evaluate whether there was an increase in the proportion of patients discharged within 3 days of a colorectal procedure. Demographics, co-morbidities, mortality and illness severity scores, primary colorectal disease, type of procedure, postoperative medical and surgical complications, payer category, hospital characteristics, costs of care and type of discharge destination were compared for patients discharged within 72 h to the remaining.

2.1. Statistical analysis

Categorical variables were summarized by frequency (n) and percentage (%), while continuous variables were illustrated by mean and \pm standard deviation (SD). Mean postoperative length of stay and early discharge as well as the proportion of discharges within 72 h after surgery were characterized from 2002 to 2011. Inpatient expenses and the use of post-acute care services for all and early discharged patients from each year were plotted. In order to evaluate the statistical significance of the included perioperative

variables between early and late discharge groups, Chi-square test and *t*-test were used for categorical and continuous parameters respectively. By adjusting for demographics, disease, procedure, postoperative outcomes, hospital features and payer, variations in inpatient costs and post-discharge resource utilization between the two groups were assessed. To estimate risk-adjusted outcomes, a logistic regression model was used for dichotomous outcomes such as disposition to post-acute care, while a generalized regression model was used for continuous parameters including healthcare costs and postoperative length of stay. Age, gender, race, pre-existing comorbidities, type of primary colorectal diagnosis and procedure, hospital type (teaching vs. non-teaching) and size, and payer category were used as covariates. Post-acute care services were defined as any disposition to a short-term hospital, skilled nursing facility, intermediate care or other type of facility or home health care upon hospital discharge. Statistical analyses were performed using version 9.4, SAS Institute, Inc., Cary, NC.

3. Results

For 251, 583 patients who were discharged after elective colorectal procedures from 2002 to 2011, mean and median hospital stay were 6.5 and 6 days respectively.

3.1. Trends in postoperative hospital stay, early discharge, post-acute care and inpatient costs from 2002 to 2011

The adjusted mean postoperative hospital stay for all patients reduced from 6.6 (SE: 0.02) days in 2002 to 5.9 (SE: 0.02) days in 2011 and was the shortest in 2008 (5.9, [SE: 0.02] days). However, length of stay started to increase in 2009 (6.1, [SE: 0.02] days). There was a similar pattern with discharge within the first 72 h, which had the greatest peaks in 2006, 2007 and 2008 (13.2%, [SE: 0.2%] 12.6%, [SE: 0.2%] and 12.1%, [SE: 0.2%]) respectively after which it reduced significantly in 2009 (9.4%, [SE: 0.2%]). Discharge disposition to post-acute care increased for all patients over the entire period with a peak in 2011 (19.4%, [SE: 0.3%]). Inpatient costs for all patients as well as those discharged within 72 h continued to rise (peaks: \$51,731, [SE: \$319] and \$35,120, [SE: \$484] in 2011

Table 1
Adjusted trends for postoperative length of stay, early (≤ 3 days post-op) discharge adoption, post-acute care use and costs for all and early discharged patients from 2002 to 2011.

Parameter	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	P*
Number of discharges	23,160	23,482	24,028	23,498	23,516	24,643	26,426	26,355	26,054	30,421	
Average postoperative LOS (days)	6.6	6.2	6.2	6.1	5.9	5.9	5.9	6.1	6.1	5.9	<0.001
Standard Error	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
ED adoption from total discharges	5.2%	8%	9.3%	11.1%	13.2%	12.6%	12.1%	9.4%	10.5%	11.1%	<0.001
Standard Error	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	
Average day of ED (days)	2.6	2.3	2.6	2.5	2.5	2.6	2.6	2.6	2.6	2.6	<0.001
Standard Error	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	
Post-acute care use (all patients)	12.1%	12.3%	15%	14.5%	14.1%	14.3%	15%	17.6%	18.5%	19.4%	<0.001
Standard Error	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%	
Post-acute care use (ED patients)	3%	2.8%	3.5%	2.9%	2.6%	2.9%	3%	3.6%	3.9%	3.8%	0.001
Standard Error	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.2%	
Inpatient costs (all patients)	\$27,096	\$30,525	\$31,735	\$34,672	\$37,071	\$39,712	\$43,567	\$44,622	\$48,224	\$51,731	<0.001
Standard Error	\$181	\$202	\$208	\$230	\$245	\$257	\$269	\$287	\$313	\$319	
Inpatient costs (all patients) ^a	\$37,974	\$41,124	\$40,962	\$42,938	\$44,135	\$45,278	\$47,898	\$47,549	\$49,691	\$51,731	<0.001
Standard Error	\$254	\$273	\$268	\$285	\$292	\$293	\$295	\$306	\$323	\$319	
Inpatient costs (ED patients)	\$17,643	\$20,733	\$20,976	\$22,542	\$25,175	\$26,872	\$29,749	\$30,813	\$32,384	\$35,120	<0.001
Standard Error	\$480	\$457	\$427	\$431	\$442	\$470	\$461	\$486	\$488	\$484	
Inpatient costs (ED patients) ^a	\$24,726	\$27,932	\$27,075	\$27,916	\$29,972	\$30,639	\$32,706	\$32,835	\$33,369	\$35,120	<0.001
Standard Error	\$672	\$615	\$552	\$534	\$526	\$536	\$506	\$518	\$503	\$484	

LOS: Length of stay, ED: Early discharge.

Years were adjusted for age, gender, race, co-morbidity, diagnosis, procedure, postoperative complications, hospital and payer.

*Type 3 tests were used to calculate *p*-values, which measure the differences across years.

^a Adjusted to the inflation (CPI) of 2011.

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