

Relation Between Hospital Length of Stay and Quality of Care in Patients With Acute Coronary Syndromes (from the American Heart Association's Get With the Guidelines—Coronary Artery Disease Data Set)



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Worries regarding short length of stay (LOS) adversely impacting quality of care prompted us to assess the relation between hospital LOS and inpatient guideline adherence in patients with acute coronary syndrome. We used the American Heart Association's Get with The Guidelines (GWTG)—Coronary Artery Disease data set. Data were collected from January 2, 2000, to March 21, 2010, for patients with acute coronary syndrome from 405 different sites. Of the 119,398 patients in the study, the mean LOS was 5.5 days with a median of 4 days. There was no difference in the LOS on the basis of hospital size, hospital type, or cardiac surgery availability. The population with an LOS <4 days were younger (63.8 ± 14.1 vs 70 ± 14.5 , $p < 0.0001$), men (63.8% vs 55.3%, $p < 0.0001$) and had fewer clinical co-morbidities. The overall adherence was high in the GWTG participating hospitals. Those with the LOS <4 days were more likely to receive aspirin (adjusted odds ratio [OR] 1.12, 95% CI 1.06 to 1.19; $p < 0.001$), clopidogrel (OR 1.77, 95% CI 1.60 to 1.95; $p < 0.001$), lipid-lowering therapy if indicated (OR 1.13, 95% CI 1.05 to 1.21; $p < 0.001$), angiotensin-converting enzyme inhibitor or angiotensin receptor blocker for left ventricular systolic dysfunction (OR 1.10, 95% CI 1.01 to 1.21; $p = 0.04$) and smoking cessation counseling (OR 1.17, 95% CI 1.1 to 1.24; $p < 0.001$) compared to those with the LOS ≥ 4 days. In contrast, those with the LOS <4 days were less likely to receive beta blockers (OR 0.88, 95% CI 0.84 to 0.93; $p < 0.001$). The odds of receiving defect-free care were greater for patients with the LOS <4 days (OR 1.15, 95% CI 1.1 to 1.21; $p < 0.001$). In conclusion, in GWTG participating hospitals, a shorter LOS did not appear to adversely affect adherence to discharge quality of care measures. © 2016 Elsevier Inc. All rights reserved. (Am J Cardiol 2016;117:201–205)

In the year 2009, 1.19 million inpatients were discharged with a primary or secondary diagnosis of acute coronary syndrome (ACS).¹ The American College of Cardiology and the American Heart Association have published guidelines in regards to quality of care measures for this ACS population.² These guidelines include: aspirin, clopidogrel, β blockers, lipid-lowering medications, along with smoking cessation counseling to name a few. These interventions have shown to improve outcomes in the ACS population in various studies.^{3,4} Despite the proved efficacy of these measures and implicit guideline recommendations, there still exists a gap between these recommendations and actual clinical practice.^{5,6} Also, in today's practice environment, with many

cost-saving measures in place, there is a strong push to discharge patients as soon as possible. Recent data have shown a steady decrease in length of stay (LOS) for ACS over the past decade.^{7,8} A worry of clinicians has been that a "push" to quickly discharge patients in an effort to save money, might adversely impact quality of care. Our aim was to assess the relation between hospital LOS and inpatient guideline adherence in patients with ACS.

Methods

We used the American Heart Association's Get With The Guidelines (GWTG) - Coronary Artery Disease data set. The components of the GWTG program, previously described, include organizational stakeholder and opinion leader meetings, hospital recruitment, collaborative learning sessions, hospital tool kits, local clinical champions, and hospital recognition.⁹ The GWTG database measures hospitals' adherence to secondary prevention guidelines (pharmacologic and lifestyle interventions) for coronary artery disease, heart failure, and stroke. This study included 119,398 patients admitted with ACS at 405 hospitals from January 2, 2000, to March 21, 2010.

Measures assessed in GWTG-Coronary Artery Disease have been previously described.⁹ Performance measures were

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Table 1
Hospital characteristics

Variable	Total (N = 119,398)	Length of Stay (Days)		P-Value
		< 4 (N = 55,408)	≥ 4 (N = 63,990)	
Bed Size	Median (25%, 75%)	340(228,505)	346(228,505)	0.52
	STD	250.32	247.31	
	N	117499	54511	
Residents		44631 (37.4%)	21016 (37.9%)	<0.0001
Primarily PCI for STEMI		106869 (89.5%)	49727(89.8%)	0.0004
Cardiac Surgery Available		95783 (80.2%)	44281 (79.9%)	0.1329
Heart Transplant Center		12897 (10.8%)	5999 (10.8%)	0.6759
Interventional Hospital		87823 (73.6%)	41003 (74.0%)	0.0462
Hospital Type – Academic		66781 (55.9%)	31011 (56.0%)	0.6382
Region	Northeast	20562 (17.2%)	8246(14.9%)	<0.0001
	Midwest	33013 (27.7%)	15548(28.1%)	
	South	37901 (31.7%)	16729(30.2%)	
	West	27922 (23.4%)	14885(26.9%)	

evaluated on the basis of time of discharge. Definitions for aspirin, β blockers, angiotensin-converting enzyme inhibitor or angiotensin receptor blocker (ACEI/ARB) in patients with left ventricular systolic dysfunction (LVSD), and smoking cessation counseling were based on the Joint Commission specifications. An additional performance measure, ACEI/ARB use in all patients with ACS at all levels of left ventricular function, was evaluated using the Joint Commission criteria except for ejection fraction percentage. New lipid-lowering therapy was defined as the percentage of patients who had a low-density lipoprotein (LDL) cholesterol >100 mg/dl without previous treatment, discharged on lipid-lowering therapy. Composite performance measure for 100% compliance was defined as patients discharged on all the following: aspirin, β blockers, ACEI/ARB in patients with LVSD, smoking cessation counseling, and lipid-lowering therapy for LDL cholesterol >100 mg/dl.

Quality of care measures and the characteristics of both the patients and participating hospitals were described by LOS groups. LOS was dichotomized above and below the median; <4 days and \geq 4 days. For descriptive analyses, medians (25th and 75th percentiles) were reported for continuous variables and percentages for categorical variables. Comparisons between patients with shorter and longer LOS were made using the Pearson's chi-square test for categorical variables and Kruskal–Wallis test for continuous variables. The change of LOS over calendar years was tested using Cochran–Mantel–Haenszel nonzero correlation statistic. Multivariate regression analysis was performed to examine the effect of LOS on the use of evidence-based treatments. A secondary analysis was performed after excluding surgically revascularized patients. All statistical analyses were performed using SAS software, version 9.1, (SAS Institute Inc., Cary, North Carolina).

Results

Data were collected from January 2, 2000, to March 21, 2010, for patients with ACS from 405 different sites. Of the 119,398 patients in the study, the mean LOS was 5.5 days with a median (25th and 75th percentiles) of 4 (2 to 7) days and 54% of patients were discharged at \geq 4 days. Hospital

Table 2
Patient characteristics

	Length of Stay (Days)		P-Value
	< 4	≥ 4	
Patients	55,408	63,990	
Age, (yrs) (SD)	63 (53, 75)	67 (56, 79)	<0.0001
Male	63.8%	55.3%	<0.0001
Race/Ethnicity			
White	73.4%	72.4%	<0.0001
Black	7.7%	9%	
Hispanic	7.8%	7.9%	
Diabetes, Insulin	2126 (4.2%)	3542(5.9%)	<0.0001
Diabetes, Non-Insulin	4127 (8.1%)	5399(9.0%)	<0.0001
Atrial Fibrillation	2765 (5.5%)	6470 (10.8%)	<0.0001
Hypertension	33686(66.4%)	43174 (72.1%)	<0.0001
Hyperlipidemia	24611(48.5%)	26338(44.0%)	<0.0001
Smoking	18440(33.3%)	15832(24.7%)	<0.0001
Coronary Artery Disease	8783(17.3%)	9975(16.7%)	0.0051
Payment Source			
Medicare	23.7%	33.9%	<0.0001
Medicaid	5.8%	7.4%	
Other	46.8%	37.9%	
No	9.2%	6.9%	
Insurance/Missing			
Diagnosis			
Unstable angina	9148(16.5%)	3265(5.1%)	<0.0001
NSTEMI	29050(52.4%)	43106(67.4%)	<0.0001
STEMI	16790(30.3%)	16919(26.4%)	<0.0001

NSTEMI = non–ST-elevation myocardial infarction, STEMI = ST-elevation myocardial infarction.

characteristics are outlined in Table 1. There was no difference in the LOS on the basis of hospital size, hospital type, or cardiac surgery availability. Hospitals with LOS <4 days were those with residents, sites with primary percutaneous intervention for ST-elevation myocardial infarction and interventional hospitals. Also, those in the Northeast and South were less likely to have an LOS <4 days compared with the other regions in the country. Patient characteristics

Table 3
Association of achieving discharge measures with length of stay

Outcome	Variable	Adjusted*	
		OR (95% CI)	P-value
Defect-free care	LOS: <4 (vs. \geq 4 days)	1.15 (1.10, 1.21)	<0.001
Discharge ACE or ARB for LVSD	LOS: <4 (vs. \geq 4 days)	1.10 (1.01, 1.21)	0.04
Discharge aspirin	LOS: <4 (vs. \geq 4 days)	1.12 (1.06, 1.19)	<0.001
Discharge beta blockers	LOS: <4 (vs. \geq 4 days)	0.88 (0.84, 0.93)	<0.001
Discharge clopidogrel for AMI and pts with percutaneous intervention	LOS: <4 (vs. \geq 4 days)	1.77 (1.60, 1.95)	<0.001
Discharge smoking cessation/counseling for smokers	LOS: <4 (vs. \geq 4 days)	1.17 (1.10, 1.24)	<0.001
Lipid lowering drugs for LDL>100 mg/dl	LOS: <4 (vs. \geq 4 days)	1.13 (1.05, 1.21)	<0.001

ACE = angiotensin-converting enzyme inhibitor; AMI = acute myocardial infarction; ARB = angiotensin receptor blocker; LDL = low-density lipoprotein; LVSD = left ventricular systolic dysfunction.

* The models adjusted for potential confounding factors including age, gender, race, payment source, medical history, diagnosis, discharge systolic blood pressure, and treatment strategy (percutaneous coronary intervention, coronary artery bypass grafting vs medical).

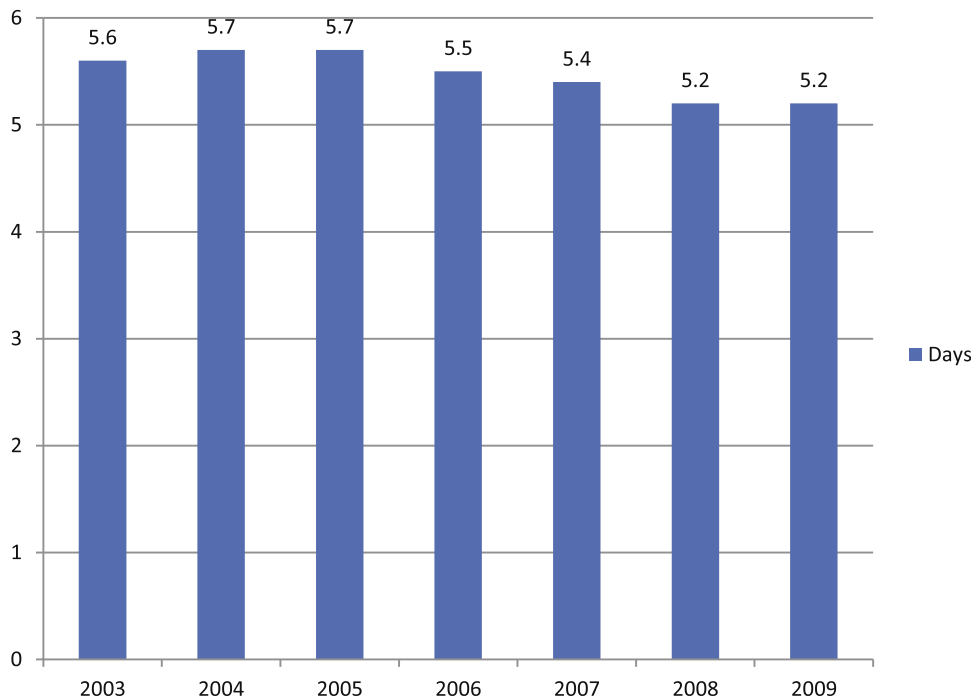


Figure 1. Mean length of stay over time in days. There has been a steady decrease in mean length of stay from 2004 to 2009.

are listed in Table 2. Compared with patients treated medically and by percutaneous coronary intervention (PCI), the mean LOS was significantly longer in patients treated with coronary artery bypass grafting (CABG; 11.4 days vs 4.1 and 5.8 days in PCI and medically treated patients). The population with the LOS <4 days were younger (63.8 ± 14.4 vs 70 ± 14.0 , $p < 0.0001$), men (63.8% vs 55.3%, $p < 0.0001$) and had fewer clinical co-morbidities.

The associations of achieving quality of care measures as a function of LOS, after adjustment for patient and hospital characteristics, are presented in Table 3. Those with the LOS <4 days were more likely to receive aspirin (odds ratio [OR] 1.12, 95% CI 1.06 to 1.19; $p < 0.001$), clopidogrel (OR 1.77, 95% CI 1.60 to 1.95; $p < 0.001$), lipid-lowering therapy if indicated (OR 1.13, 95% CI 1.05 to 1.21; $p < 0.001$), ACEI/ARB for LVSD (OR 1.10, 95% CI 1.01 to 1.21; $p = 0.04$), and smoking cessation counseling (OR 1.17, 95%

CI 1.10 to 1.24; $p < 0.001$) compared to those with the LOS \geq 4 days. In contrast, this group (LOS <4 days) was less likely to receive β blockers (OR 0.88, 95% CI 0.84 to 0.93; $p < 0.001$). The odds of receiving defect-free care were greater for patients with the LOS <4 days (OR 1.15, 95% CI 1.10 to 1.21; $p < 0.001$). We also found in our analysis that the LOS for ACS has decreased over time (Figure 1).

A secondary analysis was conducted after excluding patients who underwent CABG (Table 4). The differences between the 2 groups remained unchanged except for insignificant difference in the use of ACEI/ARB for LVSD between the 2 LOS groups.

Discussion

As opposed to what was feared, we found that patients with the LOS <4 days had significantly higher rates of

Table 4
Association of achieving discharge measures with length of stay after excluding patients with coronary artery bypass grafting

Outcome	Variable	Adjusted	
		OR (95% CI)	P-value
Defect-free care	LOS: <4 (vs. ≥4 days)	1.15 (1.10, 1.20)	<0.001
Discharge ACE or ARB for LVSD	LOS: <4 (vs. ≥4 days)	1.08 (0.98, 1.18)	0.13
Discharge aspirin	LOS: <4 (vs. ≥4 days)	1.13 (1.06, 1.20)	<0.001
Discharge beta blockers	LOS: <4 (vs. ≥4 days)	0.89 (0.85, 0.94)	<0.001
Discharge clopidogrel for AMI and pts with percutaneous intervention	LOS: <4 (vs. ≥4 days)	1.73 (1.57, 1.90)	<0.001
Discharge smoking cessation/counseling for smokers	LOS: <4 (vs. ≥4 days)	1.16 (1.09, 1.23)	<0.001
Lipid lowering drugs for LDL>100 mg/dl	LOS: <4 (vs. ≥4 days)	1.14 (1.06, 1.22)	<0.001

ACE = angiotensin-converting enzyme inhibitors; AMI = acute myocardial infarction; ARB = angiotensin receptor blockers; LDL = low-density lipoprotein; LVSD = left ventricular systolic dysfunction.

being discharged on aspirin, clopidogrel, a statin, and an ACEI/ARB for LVSD. These patients also received smoking cessation consulting more frequently than their counterparts who had the LOS ≥4 days. The defect-free composite measure was seen in relatively more of the patients with LOS <4 days. Although the group with LOS <4 days had a high absolute rate of discharge on a β blocker (94%), this was slightly higher in the group with the LOS ≥4 days. Furthermore, a secondary analysis after excluding patients with CABG, results were very similar other than the effect on ACEI/ARB for LVSD was reduced and turned insignificant.

Although most hospital characteristics did not affect hospital LOS, a greater proportion of patients with LOS <4 days were treated at hospitals with residency programs. In contrast, a greater proportion of patients with LOS >4 days were treated in the Northeast. Among patient characteristics, younger age, male gender, lack of co-morbidities, and clinical presentation as unstable angina or ST-elevation myocardial infarction were associated with the LOS <4 days.

The difference between the 2 groups was most pronounced with regard to clopidogrel. Despite substantial data that this agent improves outcomes after PCI and acute myocardial infarction, it was prescribed at discharge in only 60% of the patients with a hospital LOS ≥4 days. This could be due to a lower perceived benefit of this agent compared to other agents like aspirin and β blockers. It could also be due to a greater perceived risk of bleeding in this group of patients who were older, included a greater percentage of women and more frequently had diabetes. A higher prevalence of atrial fibrillation and consequent long-term anticoagulation could also have contributed to the perceived bleeding risk in this group. Similarly, rates of ACEI/ARB and statin therapy in the group with LOS ≥4 days were lower despite a higher prevalence of diabetes. This may in part have been due to contraindications or in-hospital complications that were not well documented. Nevertheless, the previously mentioned findings seem to highlight the suboptimal use of evidence-based therapies in the patients with ACS at the highest risk. Additionally, the possibility that certain factors (not identified in this study) associated with a longer hospital stay may be causally related to the underuse of the previously mentioned treatments in these patients cannot be excluded based on our study.

Previous studies have shown that adherence to these quality of care measures is associated with better outcomes in the ACS population.¹⁰ Our results indicate that discharging patients with ACS in 3 days or fewer did not appear to adversely impact quality of care, and in fact, these patients actually received evidence-based therapies more often.

Health care costs have received much attention in the current economic climate. There is a push to shorten hospital stay while trying to maintain quality of care provided to patients. The LOS for ACS decreased from a peak of 5.7 days in 2004 to 5.2 days in 2009. This decrease of 0.5 days reflects substantial cost savings for hospitals considering the 1.4 million admissions a year for ACS. Our analysis suggests that GWTG hospitals are adhering closely to quality of care measures at discharge and the decrease in mean LOS has not occurred at the expense of good quality patient care. These results are in concordance with previous studies in the Get With The Guideline—Heart Failure database, which suggest excellent adherence to guideline-based medical therapy in patients with shorter hospital LOS.¹¹

Our analysis shows that overall rates of adherence to quality of care measures in ACS were high in the participating hospitals. The LOS <4 days did not adversely impact the rate of prescription of aspirin, β blockers, clopidogrel (for acute myocardial infarction or PCI), lipid-lowering therapy (for LDL >100 mg/dl), and ACEI/ARB (for LVSD) or the rate of provision of smoking cessation counseling. This suggests that the cost savings associated with a shorter hospital stay in patients with ACS do not come at the expense of quality of care. Additionally, there is a need to develop interventions for improving adherence to quality of care measures in patients with ACS with a longer LOS.

The limitations of this study include the lack of data regarding the use of recommended therapy and clinical outcomes after hospital discharge. Also, data were collected by medical chart review and are dependent on data entry. Contraindications and intolerance were as documented in the medical record, but a proportion of patients reported to be eligible for treatment but not treated may have had contraindications or intolerance that were present but not documented. In addition, unmeasured confounders may have contributed to the reported differences and lack of differences in conformity with performance measures

between patients discharged on weekends and those discharged on weekdays/holidays.

Disclosures

Dr. Bhatt discloses the following relationships: Advisory Board: Cardax, Elsevier Practice Update Cardiology, Medscape Cardiology, and Regado Biosciences; Board of Directors: Boston VA Research Institute and Society of Cardiovascular Patient Care; Chair: American Heart Association Get With The Guidelines Steering Committee; Data Monitoring Committees: Duke Clinical Research Institute, Harvard Clinical Research Institute, Mayo Clinic, and Population Health Research Institute; Honoraria: American College of Cardiology (Senior Associate Editor, Clinical Trials and News, *ACC.org*), Belvoir Publications (Editor in Chief, Harvard Heart Letter), Duke Clinical Research Institute (clinical trial steering committees), Harvard Clinical Research Institute (clinical trial steering committee), HMP Communications (Editor in Chief, Journal of Invasive Cardiology), Journal of the American College of Cardiology (Associate Editor), Population Health Research Institute (clinical trial steering committee), Slack Publications (Chief Medical Editor, Cardiology Today's Intervention), and WebMD (CME steering committees); Other: Clinical Cardiology (Deputy Editor); Research Funding: Amarin, AstraZeneca, Biotronik, Bristol-Myers Squibb, Eisai, Ethicon, Forest Laboratories, Ischemix, Medtronic, Pfizer, Roche, Sanofi Aventis, St. Jude Medical, and The Medicines Company; Trustee: American College of Cardiology; and Unfunded Research: FlowCo, PLx Pharma, and Takeda.

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