

TRANSFORMING HEALTHCARE

Caring for Patients in a Hospitalist-Run Clinical Decision Unit Is Associated With Decreased Length of Stay Without Increasing Revisit Rates

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BACKGROUND: Observation medicine is a growing field with increasing involvement by hospitalists. Little has been written regarding clinical outcomes in hospitalist-run clinical decision units (CDUs).

OBJECTIVE: To determine the impact of a hospitalist-run geographic CDU on length of stay (LOS) for observation patients. Secondary objectives included examining the impact on 30-day emergency department (ED) or hospital revisit rates.

DESIGN: Retrospective cohort study with pre- and post-implementation analysis.

SETTING: Urban, academic, 600-bed teaching hospital in Camden, New Jersey.

PATIENTS: Observation patients discharged from medical-surgical units before and after CDU opening and those discharged from the CDU after CDU opening.

INTERVENTION: Creation of a hospitalist-run, 20-bed geographic CDU, adjacent to the ED with order sets, protocols, and priority consults and testing.

MEASUREMENTS: Median LOS for observation patients was calculated for 7 months pre- and post-CDU implementation. ED and hospital revisits requiring an observation or inpatient stay within 30 days of discharge were measured.

RESULTS: CDU observation patients had a lower median LOS than medical-surgical observation patients during the same period (17.6 hours vs 26.1 hours, $P < 0.001$). CDU LOS was lower than medical-surgical observation LOS in the 7 months 1 year prior to CDU implementation (17.6 hours vs 27.1 hours, $P < 0.001$). CDU patients had a similar 30-day ED or hospital revisit rate compared with observation patients pre-CDU.

CONCLUSIONS: Implementing a hospitalist-run geographic CDU was associated with a 35% decrease in observation LOS for CDU patients compared with a 3.7% decrease for medical-surgical observation patients. CDU LOS decreased without increasing ED or hospital revisit rates. *Journal of Hospital Medicine* 2014;9:391-395. © 2014 Society of Hospital Medicine

Hospitalists play a crucial role in improving hospital throughput and length of stay (LOS). The clinical decision unit (CDU) or observation unit (OU) is a strategy that was developed to facilitate both aims. CDUs and OUs are units where patients can be managed in the hospital for up to 24 hours prior to a decision being made to admit or discharge. Observation care is provided to patients who require further treatment or monitoring beyond what is accomplished in the emergency department (ED), but who do not require inpatient admission. CDUs arose in the 1990s in response to a desire to decrease inpatient costs as well as changing Medicare guidelines, which recognized observation status. Initially, CDUs and OUs were located within the ED and run by emergency medicine physicians. How-

ever, at the turn of the 21st century, hospitalists became involved in observation medicine, and the Society of Hospital Medicine issued a white paper on the OU in 2007.¹ Today, up to 50% of CDUs and OUs nationally are managed by hospitalists and located physically outside of the ED.^{2,3}

Despite the fact that nearly half of all CDUs and OUs nationally are run by hospitalists, there has been little published regarding the impact of hospitalist-driven units. This study demonstrates the effect of observation care delivered in a hospitalist-run geographic CDU. The primary objective was to determine the impact on LOS for patients in observation status managed in a hospitalist-run CDU compared with LOS for observation patients with the same diagnoses cared for on medical-surgical units prior to the existence of the CDU. The secondary objective was to determine the effect on the 30-day ED or hospital revisit rate, as well as ED LOS. This work will guide health systems, hospitalist groups, and physicians in their decision making regarding the future structure and process of CDUs.

METHODS

Study Design

The Cooper University Hospital institutional review board approved this study. The study took place at

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Cooper University Hospital, a large, urban, academic safety-net hospital providing tertiary care located in Camden, New Jersey.

We performed a retrospective observational study of all adult observation encounters at the study hospital from July 2010 to January 2011, and July 2011 through January 2012. During the second time period, patients could have been managed in the CDU or on a medical-surgical unit. We recorded the following demographic data: age, gender, race, principal diagnosis, and payer, as well as several outcomes of interest, including: LOS (defined as the time separating the admitting physician order from discharge), ED visits within 30 days of discharge, and hospital revisits (observation or inpatient) within 30 days.

Data Sources

Data were culled by the institution's performance improvement department from the electronic medical record, as well as cost accounting and claims-based sources.

Clinical Decision Unit

The CDU at Cooper University Hospital opened in June 2011 and is a 20-bed geographically distinct unit adjacent to the ED. During the study period, it was staffed 24 hours a day by a hospitalist and a nurse practitioner as well as dedicated nurses and critical care technicians. Patients meeting observation status in the ED were eligible for the CDU provided that they fulfilled the CDU placement guidelines including that they were more likely than not to be discharged within a period of 24 hours of CDU care, did not meet inpatient admission criteria, did not require new placement in a rehabilitation or extended-care facility, and did not require one-on-one monitoring. Additional exclusion criteria included severe vital sign or laboratory abnormalities. The overall strategy of the guidelines was to facilitate a "pull culture," where the majority of observation patients were brought from the ED to the CDU once it was determined that they did not require inpatient care. The CDU had order sets and protocols in place for many of the common diagnoses. All CDU patients received priority laboratory and radiologic testing as well as priority consultation from specialty services. Medication reconciliation was performed by a pharmacy technician for higher-risk patients, identified by Project BOOST (Better Outcomes by Optimizing Safe Transitions) criteria.⁴ Structured multidisciplinary rounds occurred daily including the hospitalist, nurse practitioner, registered nurses, case manager, and pharmacy technician. A discharge planner was available to schedule follow-up appointments.

Although chest pain was the most common CDU diagnosis, the CDU was designed to care for the majority of the hospital's observation patients rather than focus specifically on chest pain. Patients with

chest pain who met observation criteria were transferred from the ED to the CDU, rather than a medical-surgical unit, provided they did not have: positive cardiac enzymes, an electrocardiogram indicative of ischemia, known coronary artery disease presenting with pain consistent with acute coronary syndrome, need for heparin or nitroglycerin continuous infusion, symptomatic or unresolved arrhythmia, congestive heart failure meeting inpatient criteria, hypertensive urgency or emergency, pacemaker malfunction, pericarditis, or toxicity from cardiac drugs. Cardiologist consultants were involved in the care of nearly all CDU patients with chest pain.

Observation Status Determination

During the study period, observation status was recommended by a case manager in the ED based on Milliman (Milliman Care Guidelines) or McKesson InterQual (McKesson Corporation) criteria, once it was determined by the ED physician that the patient had failed usual ED care and required hospitalization. Observation status was assigned by the admitting (non-ED) physician, who placed the order for inpatient admission or observation. Other than the implementation of the CDU, there were no significant changes to the process or criteria for assigning observation status, admission order sets, or the hospital's electronic medical record during this time period.

Statistical Analysis

Continuous data are presented as mean (\pm standard deviation [SD]) or median (25%–75% interquartile range) as specified, and differences were assessed using one-way analysis of variance testing and Mann-Whitney *U* testing. Categorical data are presented as count (percentage) and differences evaluated using χ^2 analysis. *P* values of 0.05 or less were considered statistically significant.

To account for differences in groups with regard to outcomes, we performed a multivariate regression analysis. The following variables were entered: age (years), gender, race (African American vs other), admission diagnosis (chest pain vs other), and insurance status (Medicare vs other). All variables were entered simultaneously without forcing. Statistical analyses were done using the SPSS 20.0 Software (SPSS Inc., Chicago, IL).

RESULTS

Demographics

There were a total of 3735 patients included in the study: 1650 in the pre-CDU group, 1469 in the post-CDU group, and 616 in the post-CDU group on medical-surgical units. The post-CDU period had a total of 2085 patients. Patients in the CDU group were younger and were more likely to have chest pain as the admission diagnosis. Patient demographics are presented in Table 1.

TABLE 1. Patient Demographics by Group

Variable	Pre-CDU, n = 1,650	Post-CDU, n = 1,469	Post-Non-CDU, n = 616	P, CDU vs Pre-CDU	P, Non-CDU vs Pre-CDU	P, CDU vs Non-CDU
Age, y [range]	56 [45–69]	53 [43–64]	57 [44.3–70]	<0.001	0.751	0.001
Female gender	918 (55.6%)	833(56.7%)	328 (53.2%)	0.563	0.319	0.148
African American race	574 (34.8%)	505 (34.4%)	174 (28.2%)	0.821	0.004	0.007
Admission diagnosis						
Chest pain	462 (38%)	528 (35.9%)	132 (21.4%)	<0.001	0.002	<0.001
Syncope	93 (5.6%)	56 (3.8%)	15 (2.4%)	0.018	0.001	0.145
Abdominal pain	46 (2.8%)	49 (3.3%)	20(3.2%)	0.404	0.575	1.0
Other	1,049 (63.6%)	836 (56.9%)	449 (72.9%)	<0.001	<0.001	<0.001
Third-party payer						
Medicare	727 (44.1%)	491 (33.4%)	264(43.4%)	<0.001	0.634	<0.001
Charity care	187 (11.3%)	238 (16.2%)	73 (11.9%)	<0.001	0.767	0.010
Commercial	185 (11.1%)	214 (14.6%)	87 (14.1%)	0.005	0.059	0.838
Medicaid	292 (17.7%)	280 (19.1%)	100 (16.2%)	0.331	0.454	0.136
Other	153 (9.3%)	195 (13.3%)	60 (9.9%)	<0.001	0.746	0.028
Self-pay	106 (6.4%)	51(3.5%)	32 (5.2%)	<0.001	0.323	0.085

NOTE: Abbreviations: CDU, clinical decision unit.

TABLE 2. Revisit Rates and Length of Stay Pre- and Post-CDU Implementation

Outcome	Pre-CDU, n = 1,650	Post-CDU, n = 1,469	Post-Non-CDU, n = 616	P, CDU vs Pre-CDU	P, Non-CDU vs Pre-CDU	P, CDU vs Non-CDU
All patients, n = 3,735						
30-day ED or hospital revisit	326 (19.8%)	268 (18.2%)	123 (17.2%)	0.294	0.906	0.357
Median LOS, h	27.1 [17.4–46.4]	17.6 [12.1–22.8]	26.1 [16.9–41.2]	<0.001	0.004	<0.001
Chest-pain patients, n = 1,122						
30-day ED or hospital revisit	69 (14.9%)	82 (15.5%)	23 (17.4%)	0.859	0.496	0.596
Median LOS, h	22 [15.8–38.9]	17.3 [10.9–22.4]	23.2 [13.8–43.1]	<0.001	0.995	<0.001
Other diagnoses, n = 2,613						
30-day ED or hospital revisit	257 (21.6%)	186 (19.8%)	100 (18.4%)	0.307	0.693	0.727
Median LOS, h	30.4 [18.6–49.4]	17.8 [12.9–23]	26.7 [17.2–31.1]	<0.001	<0.001	<0.001

NOTE: Abbreviations: CDU, clinical decision unit; ED, emergency department; LOS, length of stay.

Outcomes of Interest

There was a statistically significant association between LOS and CDU implementation (Table 2). Observation patients cared for in the CDU had a lower LOS than observation patients cared for on the medical–surgical units during the same time period (17.6 vs 26.1 hours, $P < 0.0001$).

In total, there were 717 total revisits including ED visits and hospital stays within 30 days of discharge (Table 2). Of all the observation encounters in the study, 19.2% were followed by a revisit within 30 days. There were no differences in the 30-day post-ED visit rates in between periods and between groups.

Mean ED LOS for hospitalized patients was examined for a sample of the pre- and post-CDU periods, namely November 2010 to January 2011 and November 2011 to January 2012. The mean ED LOS decreased from 410 minutes (SD = 61) to 393 minutes (SD = 51) after implementation of the CDU ($P = 0.037$).

To account for possible skewing of the data, we transformed LOS into ln (natural log) LOS and found the following means (SD): group 1 was 3.27 (0.94), group 2 was 2.78 (0.6), and group 3 was 3.1 (0.93). Using an independent t test, we found a significant difference between groups 1 and 2, 2 and 3, as well as 1 and 3 ($P < 0.001$ for all).

Chest-Pain Subgroup Analysis

We analyzed the data specifically for the 1122 patients discharged with a diagnosis of chest pain. LOS was significantly lower for patients in the CDU compared to either pre-CDU or observation on floors (Table 2).

Multivariate Regression Analysis

We performed a linear regression analysis using the following variables: age, race, gender, diagnosis, insurance status, and study period (pre-CDU, post-CDU, and post-non-CDU). We performed 3 different comparisons: pre-CDU vs post-CDU, post-non-CDU vs post-CDU, and post-non-CDU vs pre-CDU. After adjusting for other variables, the post-non-CDU group was significantly associated with higher LOS ($P < 0.001$). The pre-CDU group was associated with higher LOS than both the post-CDU and post-non-CDU groups ($P < 0.001$ for both).

DISCUSSION

In our study of a hospitalist-run CDU for observation patients, we observed that the care in the CDU was associated with a lower median LOS, but no increase in ED or hospital revisits within 30 days.

Previous studies have reported the impact of clinical observation or clinical diagnosis units, particularly

chest-pain units.^{5–15} Studies of hospitalist-run units suggest shorter LOS in the entire hospital,¹⁶ or in the target unit.¹⁷ Although one study suggested a lower 30-day readmission rate,¹⁸ most others did not describe this effect.^{16,17} Our study differs from previous research in that our program employed a pull-culture aimed at accepting the majority of observation status patients without focusing on a particular diagnosis. We also implemented a structured multidisciplinary team focused on expediting care and utilized BOOST-framed transitions, including targeted medication reconciliation and tools such as teach-back.

The CDU in our hospital produced shorter LOS even compared to our non-CDU units, but the revisit rate did not improve despite activities to reduce revisits. During the study period, efforts to decrease readmissions were implemented in various areas of our hospital, but not a comprehensive institution-wide readmissions strategy. Lack of impact on revisits could be viewed as a positive finding, in that shorter LOS did not result in patients being discharged home before clinically stable. Alternatively, lack of impact could be due to the uncertain effectiveness of BOOST specifically^{19–21} or inpatient-targeted transitions interventions more generally.²²

Our study has certain limitations. Findings in our single-center study in an urban academic medical center may not apply to CDUs in other settings. As a pre–post design, our study is subject to external trends for which our analyses may be unable to account. For example, during CDU implementation, there were hospital-wide initiatives aimed at improving inpatient LOS, including complex case rounds, increased use of active bed management, and improved case management efforts to decrease LOS. These may have been a factor in the small decrease in observation LOS seen in the medical–surgical patients during the post period. Additionally, though we have attempted to control for possible confounders, there could have been differences in the study groups for which we were unable to account, including code status or social variables such as homelessness, which played a role in our revisit outcomes. The decrease in LOS by 35%, or 9.5 hours, in CDU patients is clinically important, as it allows low-risk patients to spend less time in the hospital where they may have been at risk of hospital-acquired conditions; however, this study did not include patient satisfaction data. It would be important to measure the effect on patient experience of potentially spending 1 fewer night in the hospital. Finally, our CDU was designed with specific clinical criteria for inclusion and exclusion. Patients who were higher risk or expected to need more than 24 hours of care were not placed in the CDU. We were not able to adjust our analyses for factors that were not in our data, such as severe vital sign or laboratory abnormalities or a physician's clinical impression of a patient. It is possible, therefore, that referral bias may have

occurred and influenced our results. The fact that non-CDU chest-pain patients in the post-CDU period did not experience any decrease in LOS, whereas other medical–surgical observation patients did, may be an example of this bias. Patients were excluded from the CDU by virtue of being deemed higher risk as described in Methods section. We were unable to adjust for these differences.

Implementation of CDUs may be useful for health systems seeking to improve hospital throughput and improve utilization among common but low-acuity patient groups. Although our initial results are promising, the concept of a CDU may require enhancements. For example, at our hospital we are addressing transitions of care by looking at models that address patient risk through a systematic process, and then target individuals for specific interventions to prevent revisits. Moreover, the study of CDUs should report impact on patient and referring physician satisfaction, and whether CDUs can reduce per-case costs.

CONCLUSION

Caring for patients in a hospitalist-run geographic CDU was associated with a 35% decrease in observation LOS for CDU patients compared with a 3.7% decrease for observation patients cared for elsewhere in the hospital. CDU patients' LOS was significantly decreased without increasing ED or hospital revisit rates.

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References

1. The observation unit: an operational overview for the hospitalist. Society of Hospital Medicine website. Available at: http://www.hospitalmedicine.org/AM/Template.cfm?Section=White_Papers&Template=/CM/ContentDisplay.cfm&ContentID=21890. Accessed on April 12, 2013.
2. Wiler JL, Griffey RT, Olsen T. Review of modeling approaches for emergency department patient flow and crowding research. *Acad Emerg Med*. 2011;18(12):1371–1379.
3. Venkatesh AK, Geisler BP, Gibson Chambers JJ, Baugh CW, Bohan JS, Schuur JD. Use of observation care in US emergency departments, 2001 to 2008. *PLoS One*. 2011;6(9):e24326.
4. The Society of Hospital Medicine Project Boost (Better Outcomes by Optimizing Safe Transitions) Available at: <http://www.hospitalmedicine.org/boost>. Accessed on June 4, 2013.
5. Gomez MA, Anderson JL, Karagounis LA, Muhlestein JB, Mooers FB. An emergency department-based protocol for rapidly ruling out myocardial ischemia reduces hospital time and expense: results of a randomized study (ROMIO). *J Am Coll Cardiol*. 1996;28(1):25–33.
6. Siebens K, Miljoen H, Fieuw S, Drew B, De Geest S, Vrints C. Implementation of the guidelines for the management of patients with chest pain through a critical pathway approach improves length of stay and patient satisfaction but not anxiety. *Crit Pathw Cardiol*. 2010;9(1):30–34.
7. Roberts RR, Zalenski RJ, Mensah EK, et al. Costs of an emergency department-based accelerated diagnostic protocol vs hospitalization in patients with chest pain: a randomized controlled trial. *JAMA*. 1997;278(20):1670–1676.
8. Hoekstra JW, Gibler WB, Levy RC, et al. Emergency-department diagnosis of acute myocardial infarction and ischemia: a cost analysis of two diagnostic protocols. *Acad Emerg Med*. 1994;1(2):103–110.
9. Graff LG, Dallara J, Ross MA, et al. Impact on the care of the emergency department chest pain patient from the chest pain evaluation registry (CHEPER) study. *Am J Cardiol*. 1997;80(5):563–568.
10. Gaspoz JM, Lee TH, Weinstein MC, et al. Cost-effectiveness of a new short-stay unit to “rule out” acute myocardial infarction in low risk patients. *J Am Coll Cardiol*. 1994;24(5):1249–1259.
11. Rydman RJ, Isola ML, Roberts RR, et al. Emergency Department Observation Unit versus hospital inpatient care for a chronic

- asthmatic population: a randomized trial of health status outcome and cost. *Med Care*. 1998;36(4):599–609.
12. McDermott MF, Murphy DG, Zalenski RJ, et al. A comparison between emergency diagnostic and treatment unit and inpatient care in the management of acute asthma. *Arch Intern Med*. 1997;157(18):2055–2062.
 13. Tham KY, Kimura H, Nagurney T, Volinsky F. Retrospective review of emergency department patients with non-variceal upper gastrointestinal hemorrhage for potential outpatient management. *Acad Emerg Med*. 1999;6(3):196–201.
 14. Longstreth GF, Feitelberg SP. Outpatient care of selected patients with acute non-variceal upper gastrointestinal haemorrhage. *Lancet*. 1995;345(8942):108–111.
 15. Hostetler B, Leikin JB, Timmons JA, Hanashiro PK, Kissane K. Patterns of use of an emergency department-based observation unit. *Am J Ther*. 2002;9(6):499–502.
 16. Leykum LK, Huerta V, Mortenson E. Implementation of a hospitalist-run observation unit and impact on length of stay (LOS): a brief report. *J Hosp Med*. 2010;5(9):E2–E5.
 17. Myers JS, Bellini LM, Rohrbach J, Shofer FS, Hollander JE. Improving resource utilization in a teaching hospital: development of a nonteaching service for chest pain admissions. *Acad Med*. 2006;81(5):432–435.
 18. Abenhaim HA, Kahn SR, Raffoul J, Becker MR. Program description: a hospitalist-run, medical short-stay unit in a teaching hospital. *CMAJ*. 2000;163(11):1477–1480.
 19. Hansen L, Greenwald JL, Budnitz T, et al. Project BOOST: effectiveness of a multihospital effort to reduce rehospitalization. *J Hosp Med*. 2013;8:421–427.
 20. Auerbach A, Fang M, Glasheen J, et al. BOOST: evidence needing a lift. *J Hosp Med*. 2013;8:468–469.
 21. Jha AK. BOOST and readmissions: thinking beyond the walls of the hospital. *J Hosp Med*. 2013;8:470–471.
 22. Renne S, Nguyen OK, Shoeb MH, et al. Hospital-initiated transitional care interventions as a patient safety strategy. *Ann Int Med*. 2013;158:433–440.