Successful Implementation of a Referral-based Academic Pediatric Hospitalist Service

abstract

OBJECTIVE: St Louis Children's Hospital (SLCH) developed Service for Hospital Admissions by Referring Physicians (SHARP) in January 2008 as an inpatient referral service for pediatricians who previously admitted their own patients. We hypothesized that use of SHARP would make hospitalization more efficient and cost-effective compared with the general pediatric medicine (GM) service.

METHODS: Admission volumes, diagnoses, length of stay (LOS), costs, and physician billing data were abstracted from SLCH information systems and the Pediatric Health Information System database. We compared admissions for SHARP and GM from January 2008 through June 2010.

RESULTS: SHARP had lower LOS and costs versus GM, with no change in 7-day readmission rate. Median LOS was 2 days for SHARP and 3 days for GM ($P < .001$). Median hospital cost per patient was $2719 for SHARP and $3062 for GM ($P < .001$). Over the study period, the admission rate increased 37% and daily patient encounters increased 39%. Physician billing revenue increased 25% in the first 6 months, then continued to increase steadily. Total physicians and geographic referral area using SHARP increased, and referring physician satisfaction was high.

CONCLUSIONS: SHARP approaches financial independence and provides a cost savings to SLCH. LOS decreased by a statistically significant amount compared with GM with no change in readmission rate. Referring physician satisfaction was high, likely allowing for growth in referrals to SLCH. SHARP hospitalists' collaboration with referring physicians, ensuring excellent follow-up, provides decreased duration of hospitalization and resource utilization. Our availability throughout the day to reassess patients increases efficiency. We project that we must average 12.6 daily encounters to be financially independent.

The field of pediatric hospital medicine is well established and continues to expand.[1,2] Previous studies have indicated that hospitalist care is associated with decreased costs and length of stay (LOS).[1,3,4] However, there are significant challenges to the financial sustainability of hospital medicine, with most pediatric hospitalist programs requiring some financial support beyond billing revenues.[1,5,6]

At St Louis Children's Hospital (SLCH), a quaternary care academic children's hospital with 250 inpatient beds, we developed a referral-based pediatric hospitalist inpatient service (Service for Hospital Admissions by Referring Physicians [SHARP]). We describe the organization of the service, compare SHARP with the general pediatric medicine (GM) service with respect to decreasing costs and

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KEY WORDS

cost–benefit analysis, hospitalist, length of stay

ABBREVIATIONS

APR-DRGs: All Patient Refined Diagnosis Related Groups
FFS: fee-for-service
FTE: full-time employee
GM: general pediatric medicine
LOS: length of stay
PHIS: Pediatric Health Information System
RSV: respiratory syncytial virus
SHARP: Service for Hospital Admissions by Referring Physicians
SLCH: St Louis Children's Hospital
WUSM: Washington University School of Medicine

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LOS, and review financial performance and referring physician satisfaction.

Before the initiation of SHARP in 2008, general pediatric inpatients at SLCH were cared for by their own private pediatrician or by the GM attending. The impetus for SHARP's creation was a large highway construction project that closed a major interstate and severely impeded access to the hospital. Regionally, there are 2 freestanding academic children's hospitals and a large community hospital providing a wide range of pediatric services. SLCH agreed to support the development of SHARP to retain referrals from private pediatricians during the highway closure.

Working with SLCH Physician Services, we selected private pediatricians who frequently admitted their patients to SLCH and whose travel time to the hospital would be significantly affected by the highway construction. We promised them timely and personal communication by telephone on patient admission, discharge, and at significant times during the hospital stay, as well as a dictated discharge letter faxed to the referring physician's office within 24 hours. For additional convenience, the on-service hospitalist would be available via a specific cell phone number.

A core group of senior hospitalists interested in inpatient care and who have an established rapport with private pediatricians staff SHARP. We generally see each patient twice per day to foster good communication with the patient's family and to respond promptly to changes in the patient's condition.

At SLCH, GM patients are admitted to the 6 units covered by 4 teams of residents and nurse practitioners. SHARP patients may be assigned to any of the units and are covered by the corresponding resident team. Patients are admitted to SHARP in 1 of 3 ways: through the emergency department; transfer from an outside hospital; or directly admitted by the referring physician. On admission, the admitting resident team evaluates the patient and discusses the plan of care with the SHARP hospitalist. The SHARP attending works with the resident team to provide direct patient care and liaises with the referring pediatrician. SHARP hospitalists rotate for 1 week on service, with each hospitalist covering 4 to 6 weeks per year. The SHARP physician is in-house Monday through Sunday during the day and available by pager or cell phone after hours. There is a half-day overlap on Monday mornings to allow in-person sign-outs.

Each resident team has a GM attending who oversees all GM patients but is not involved in the care of the SHARP patients. The GM service is staffed 50% of the year by a subspecialist and the other 50% by a hospitalist, rotating in 2-week blocks, with most physicians on service for 2 to 4 weeks per year. When the subspecialist is assigned to the GM service, they are the responsible physician for all GM patients on that floor. All other attending clinical responsibilities for the remainder of the year are within their own subspecialty. Private pediatricians may admit patients to their own service or use the GM service rather than SHARP.

All hospitalists and subspecialists are employed by Washington University School of Medicine (WUSM). SLCH contracts for SHARP, including 2 full-time employees (FTEs; hospitalists) and associated costs. The contracted cost for the service is offset by the revenue collected from physician professional fees. The contract is designed to cover the fully loaded cost of hospitalist staffing. The physician professional fees are collected by WUSM's Department of Pediatrics, which also incurs the cost of staffing. Our program's fully loaded costs for staffing 2 FTEs include fixed, variable, and allocated costs. Fixed costs include salary and benefits; professional liability; licensure and credentialing; laboratory coats, pagers, and badges; computers and office equipment; and continuing medical education/travel expenses. Variable costs include billing/coders and accounts payable, as well as WUSM overhead costs. Allocated costs include administration/payroll/compliance; marketing and outreach; quality improvement; space; utilities; and telephone charges.

METHODS

Data Source

We retrospectively analyzed administrative data from patients discharged from SLCH from January 2008 through June 2010. Data on patient demographic characteristics, LOS, hospital costs, admitting and discharge service, case mix index, expected LOS, and All Patient Refined Diagnosis Related Groups (APR-DRGs) (3M APR-DRG Classification System, 3M Healthcare Information Systems, Salt Lake City, UT) were obtained from the hospital's internal administrative system and the Pediatric Health Information System (PHIS) database. PHIS is an administrative database that contains data from 43 nonprofit, tertiary care pediatric hospitals in the United States. These hospitals are affiliated with the Child Health Corporation of America

(Shawnee Mission, KS), a business alliance of children's hospitals. Data quality and reliability are assured through a joint effort between the Child Health Corporation of America and participating hospitals. Our study included data only from SLCH.

Patients admitted to the SHARP or GM service during the study period were included in the analysis. Patients admitted to the GM service and discharged from SHARP were considered SHARP patients because this action occurred due to administrative error, and the patients were never seen by the GM attending. Admissions with disparate admitting and discharge services and admissions missing the discharge physician's name were excluded from the analysis. Patients with an admission to the ICU were also excluded from analysis due to variations in LOS and costs compared with those limited to non-ICU care. Data on referring physicians were collected from SLCH Planning and Business Development. Financial and billing data were obtained from the WUSM Department of Pediatrics.

In June 2008 and March 2009, SLCH Planning and Business Development conducted a survey of 140 referring physicians who used SHARP. These were retrospective surveys to evaluate referring physicians' satisfaction with SHARP. Surveys were distributed via e-mail, fax, or mail to the physician's office. No incentive was offered for completing the survey.

Definitions

LOS was calculated by subtracting the hospital admission date from the discharge date and adding 1 (ie, the first day of hospitalization was defined as day 1). Case mix index and expected LOS obtained from the PHIS database were determined from weights assigned to the APR-DRG severity of illness subclass categories. Total patient costs obtained from the PHIS database were calculated based on the ratio of cost to charges from the hospital's Medicare cost report. Both hospital charges and costs were adjusted to 2010 dollars by using the Medical Care component of the Consumer Price Index.[7]

The top 5 diagnoses for all admissions to the SHARP and GM service were analyzed by looking at the APR-DRGs: 141, asthma; 138, bronchiolitis and respiratory syncytial virus (RSV) pneumonia; 139, pneumonia; 113, infections of upper respiratory tract; and 249, nonbacterial gastroenteritis.

Analysis

Data were analyzed by using PASW version 18.0 (SPSS Inc, Chicago, IL). Analysis of categorical data was performed by using the χ^2 or the Fisher exact test, where appropriate. Analysis of continuous data was performed by using the Mann–Whitney *U* test. The Washington University Human Research Protection Office approved this study.

RESULTS

There were 13 632 admissions with GM or SHARP listed as the admitting or discharge service. A total of 4026 (29.5%) of these were excluded from analysis based on exclusion criteria: 2239 were excluded for ICU admissions; 135 for non-inpatient or observation admissions; and 1652 due to disparate admitting or discharge service, or missing or incorrect physician information. An additional 80 (<1%) admissions were excluded due to missing PHIS data. Our data analysis thus included 9526 admissions (Table 1). There was a significant difference for age ($P < .001$), which we determined was unlikely to be clinically relevant. There was no statistically significant difference regarding race or gender.

Over the 10 quarters from January 2008 through June 2010, admission rates increased 37% and daily patient encounters increased 39% (Fig 1). After the initiation of SHARP, overall referrals to SLCH from the physicians using this service increased 21% between 2007 and 2008. In comparison, overall admissions to SLCH grew by 7%. Therefore, SHARP did not shift patients away from the GM service but added to total patient volume. A growing number of private physicians, from a wider geographic area, began using SHARP during the study period. With active recruitment of referring physicians and word-of-mouth referrals, we doubled the referral radius from 24 to 48 miles and expanded from 22 to >120 private physicians referring to SHARP. SHARP also maintained referring pediatricians' satisfaction, increasing the likelihood that they would continue referring to SLCH.

Patients admitted to SHARP had a decreased LOS and decreased costs compared with those admitted to the GM service. Median LOS for the GM service was 3 days versus 2 days for SHARP ($P < .001$) (Table 1). The median expected LOS, calculated from PHIS based on APR-DRGs, remained constant at 2.43 days. Median total costs for all admissions in analysis for the GM service was $3062 versus $2719 for SHARP ($P < .001$). Complexity of patients was the same for SHARP and the

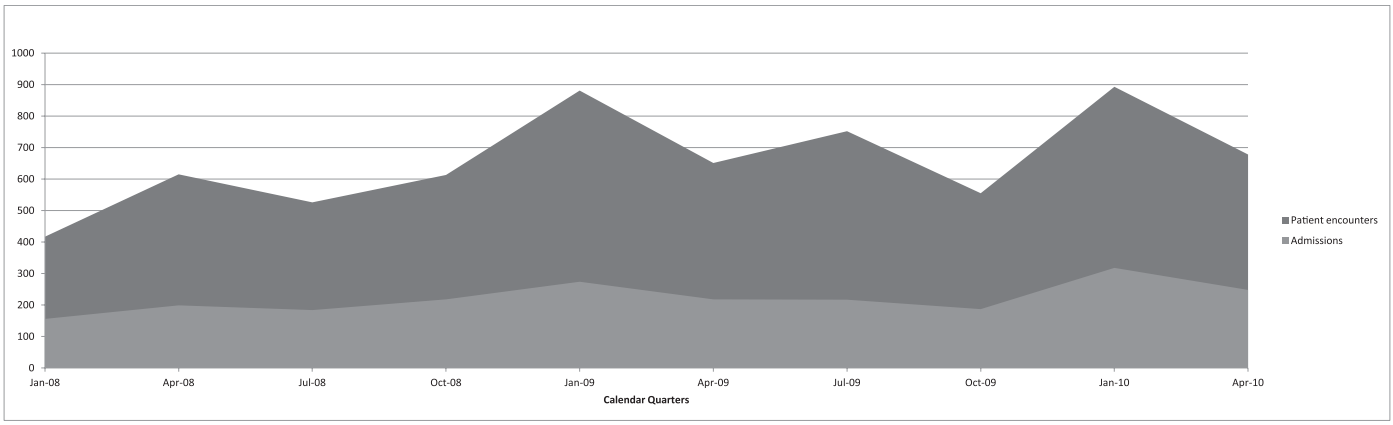

FIGURE 1 SHARP service volume for January 2008 through June 2010.

GM service, reflected by the same median expected LOS (2.43 days) and an equal median case mix index (0.69) for each group. All-cause readmissions to SLCH within 7 days were compared for the SHARP and GM service. Readmissions included inpatient and observation returns. Readmission rates were 1.9% for SHARP and 2.5% for the GM service ($P = .092$). The SHARP payer mix was found to include significantly more private insurers than the payer mix of the GM service; SHARP, 42.8% government payer; GM service, 61.2% government payer ($P < .001$).

We selected and compared the top 5 APR-DRGs for the GM service and SHARP. Patients on SHARP had a decreased LOS and decreased costs for all top 5 APR-DRGs. However, only asthma reached statistical significance when comparing total costs and LOS (Table 2).

TABLE 1 SHARP Compared With GM Services

Characteristic	SHARP ($n = 2421$)	GM Service ($n = 7105$)	*P*
Age, median (IQR), y	2.2 (0.49–7.7)	2.4 (0.48–8.96)	.012
Male gender	1324 (54.7)	3789 (53.3)	.247
Race			
Black	1002 (41.4)	3087 (43.4)	
White	1325 (54.7)	3698 (52.0)	.054
Other	94 (3.9)	320 (4.5)	
Case mix index, median (IQR)	0.69 (0.56–0.79)	0.69 (0.56–0.79)	.490
Payer			
Government	1037 (42.8)	4347 (61.2)	
Other insurer	1339 (55.3)	2632 (37.0)	<.001
Self-pay	45 (1.9)	126 (1.8)	
Top 5 APR-DRGs			
141, asthma	400 (16.5)	1113 (15.7)	.319
138, bronchiolitis and RSV pneumonia	269 (11.1)	747 (10.5)	.411
139, pneumonia	217 (9.0)	554 (7.8)	.069
113, infections of upper respiratory tract	169 (7.0)	536 (7.5)	.360
249, nonbacterial gastroenteritis	116 (4.8)	347 (4.9)	.855
LOS, median (IQR), d	2 (2–3)	3 (2–3)	<.001
Expected LOS, median (IQR), d	2.43 (1.98–2.81)	2.43 (1.98–2.83)	.944
Charges, median (IQR), US$	4508 (3086–6813)	4839 (3188–7324)	<.001
Pharmacy	294 (121–745)	319 (122–796)	.075
Laboratory	718 (330–1489)	765 (336–1565)	.135
Imaging	251 (0–744)	251 (0–744)	.389
Supplies	445 (221–804)	473 (236–846)	.014
Clinical	178 (73–709)	207 (73–821)	.110
Room and nursing	1643 (1386–2461)	1794 (1391–2598)	<.001
Estimated costs, median (IQR), US$	2719 (1873–4054)	3062 (1931–4557)	<.001
Readmission in 7 d	47 (1.9)	181 (2.5)	.092

Data are presented as number (%) of patients unless otherwise indicated. IQR, interquartile range.

Increased patient volumes resulted in a greater proportion of expenses recovered from physician billing. At the inception of SHARP, program costs exceeded patient revenues collected. However, in the first 6 months, the fee-for-service (FFS) revenue increased by 25% and continued to grow steadily over the study period. In Fig 2, the solid line at 100 reflects the point at which 100% of the fully loaded expenses/costs for staffing 2 FTEs were fully covered by physician billing. The fluctuating line is the FFS revenue collected compared with program expenses. According to the SHARP contractual agreement, the gap between the 2 lines is the service fee paid by SLCH, which ensures program sustainability. Based on the program cost structure and the average reimbursement per visit, 12.6 daily patient encounters is the number required to generate enough revenue to cover the fully loaded costs of 2 FTEs. For the study period, the program covered ~40% of the fully loaded costs from FFS revenues and 60% was covered by SLCH contract revenue. The financial sustainability of the SHARP program remains dependent on SLCH financial reimbursement.

DISCUSSION

The general trend nationwide is toward hospitalist programs providing inpatient care, in part due to time and financial pressures influencing primary pediatricians to concentrate on office-based care. The growth of our service, and the correlation of hospitalist-provided care with decreased LOS and costs, is consistent with previously published data from other pediatric hospital medicine programs.[1,8,9] Despite hospital medicine's increasing popularity, most pediatric hospitalist programs require financial support from their affiliated institutions.[10,11] Seventy percent of hospitals surveyed reported that hospitalists do not generate enough revenue to cover their costs.[6] Our need for financial reimbursement from the hospital mirrors this trend. We have determined that an average of 12.6 daily patient encounters are needed to fully cover the cost of 2 FTEs (hospitalists).

Similar to other pediatric hospital medicine programs, SHARP has faced challenges with seasonal variations in census, as well as difficulty in quantifying and obtaining reimbursement for the value hospitalists add by proximity to their patients throughout the day.

Challenges specific to our program include the logistical difficulties of seeing patients who are scattered throughout the hospital under the care of different resident teams, and keeping in touch with many different referring physicians throughout the day. We are currently obtaining each referring physician's preferred method of communication and increasing the efficient use of smart phones for texting and e-mails.

Boyd et al[12] reported that if traditional faculty teams are given dedicated time to focus on inpatient care, they can also have decreased total costs and LOS compared with a hospitalist model. Our group has tried to optimize a small subset of hospitalists who rotate frequently on SHARP while respecting the work–life balance needs of the group. Other hospitalist groups have limited the number of providers on this type of service to maintain continuity and to ensure commitment to the fundamental goals of the program.[8] SHARP has expanded from 12 providers initially to 20 hospitalists now participating in this service (from a total of 50).

We believe that part of the efficiency of SHARP results from the interaction of the hospitalists with referring pediatricians. Our familiarity with the high quality of care provided by the referring pediatricians often allows us to negotiate an earlier discharge with close follow-up in the physician's office in 24 to 48 hours. Similarly, because of our close collaborative relationship and the ease of re-referral, referring physicians may be comfortable with discharging their patients at an earlier state of convalescence or pending

TABLE 2 Analysis According to Top 5 APR-DRGs

Characteristic	SHARP	GM Service	*P*
141, asthma	*n* = 400	*n* = 1113	
LOS, d	2 (2–3)	2 (2–3)	.003
Total costs, US$	2257 (1948–3508)	2494 (2049–3648)	.002
138, bronchiolitis and RSV pneumonia	*n* = 269	*n* = 747	
LOS, d	2 (2 –3)	3 (2–3)	.444
Total costs, US$	2390 (1712–3546)	2753 (1768–4082)	.097
139, pneumonia	*n* = 217	*n* = 554	
LOS, d	3 (2–4)	3 (2–4)	.196
Total costs, US$	3173 (2039–4638)	3342 (2037–4890)	.252
113, infections of upper respiratory tract	*n* = 169	*n* = 536	
LOS, d	2 (2–3)	2 (2–3)	.964
Total costs, US$	2526 (1699–3641)	2535 (1728–3787)	.561
249, nonbacterial gastroenteritis	*n* = 116	*n* = 347	
LOS, d	2 (2–3)	2 (2–3)	.059
Total costs, US$	2082 (1660–3236)	2543 (1778–3613)	.032

Data are presented as median values (interquartile range).

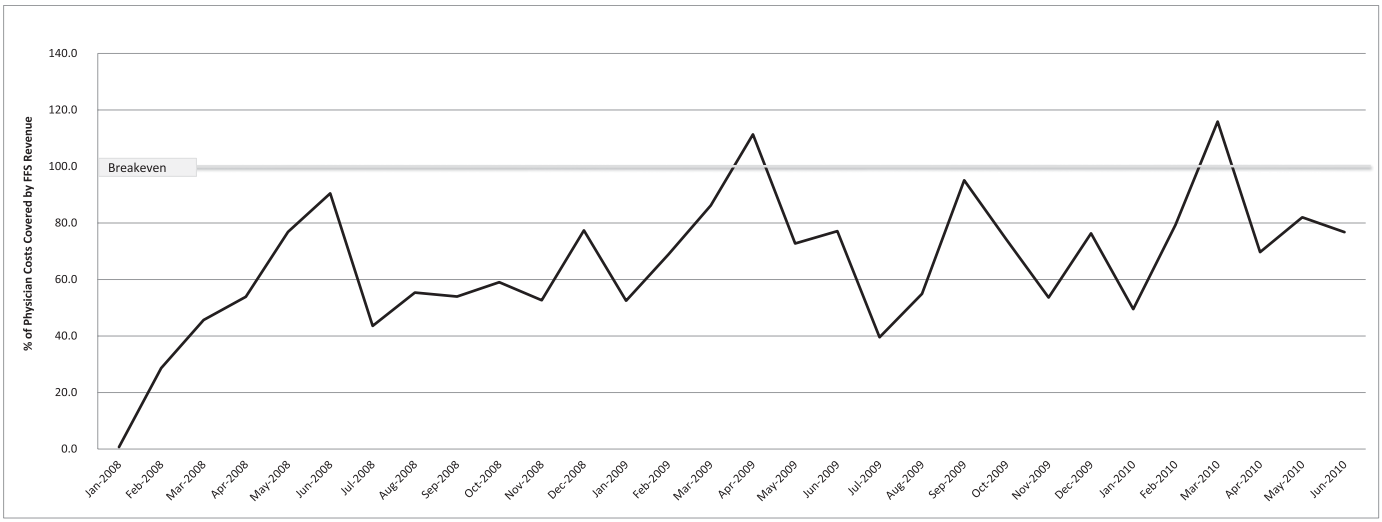

FIGURE 2 FFS revenue versus expenses for January 2008 through June 2010.

results of diagnostic studies. A hospitalist in-house is also more available to achieve timely discharges than a physician with clinic duties. With a decreased LOS, SHARP still maintained a low readmission rate comparable to the GM service with the same complexity of patients.

Our location within the hospital allows us to provide several benefits that private pediatricians are often less able to offer. We are able to assist families with the transition from PICU to floor, familiarizing ourselves with their cases from the onset and providing early evaluation and introduction to the patient's family. Evidence shows that there are deficiencies in transitions of care between the inpatient and the outpatient setting that affect patient safety.[13] SHARP improves these transitions in care through ongoing direct contact with private physicians and timely discharge summaries. In current reimbursement models, many community pediatricians feel pressure to devote a greater amount of time to ambulatory care. Our ability to spend a greater amount of time in the hospital also allows us more direct time with residents than many private physicians are able to provide. We are able to model interactions with patients and their families for the residents and medical students. Hospitalists provide valuable teaching services, particularly in light of new Accreditation Council for Graduate Medical Education guidelines.[15] SHARP physicians have had positive feedback from house staff, stating that they are easy to reach throughout the day and provide individualized teaching on their patients.

There are several limitations to our data. First, hospitalists cover the GM service ~50% of the time. To determine if there is a true difference in the efficiency of care provided by hospitalists overall, we stratified the GM service according to hospitalist, subspecialist, and private pediatrician service. We anticipated similar results when comparing hospitalists on SHARP versus hospitalists on the GM service. However, hospitalists on the GM service had the highest total costs of all 4 groups. One explanation for this finding is the increased communication between the resident team and the SHARP attending, enabling an ability to decrease costs by reducing unnecessary interventions. The residents discuss all new admissions with the SHARP hospitalist, even at night. However, hospitalists on the GM service allow more resident autonomy with overnight admissions, which may lead to increased costs. Also, the payer mix is clearly different when comparing GM service versus SHARP. GM patients have less overall access to care, and as physicians who think holistically about our patients, it is possible that we are providing more comprehensive care to these patients while they are inpatients. Other potential variables influencing these results are physician's year in practice or frequency of time on service.

In addition, our hospital data source does not allow for an easy way to track or analyze the number of consultations ordered by physicians on different services. Physician fees with consultation are billed separately through WUSM and are excluded in the "hospital costs" figure. We are

therefore unable to assess whether we are saving resources in this domain. Additionally, due to care pathways and input from excellent ancillary services, resident physicians are already providing highly efficient care for all patients, and it may therefore be difficult to demonstrate incremental improvements.

Another limitation was our ability to calculate LOS. Our data measured whole days of stay rather than hours. This method does not always take into consideration the ability hospitalists have to expedite discharges by several hours, which could contribute greatly toward patient and parent satisfaction. Furthermore, hospitalists are not financially rewarded for decreasing medical costs through measures such as earlier discharges.

Conway et al[14] surveyed hospitalists and community pediatricians and found that hospitalists reported greater adherence to evidence-based therapies and tests in the care of hospitalized patients, and less use of tests and therapies of unproven benefit. Our data are consistent with other studies which show that hospitalists decrease LOS and cost of hospitalization.[1,4] However, there is a paucity of information on improved quality of care. Future studies should focus on establishing practice guidelines, incorporation of evidence-based guidelines, and the adherence of hospitalists to these parameters.

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