

The Impact of an Inpatient Physician Program on Quality, Utilization, and Satisfaction

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Abstract

Objective: To evaluate an inpatient physician system initiated in June 1996 for all patients of a health maintenance organization admitted to the general medicine service of an urban teaching hospital. In the new program, attending physician duties were transferred from the patient's own general internist to another internist serving on a hospital-based rotation.

Study Design: Cohort with historical controls.

Participants and Methods: We compared the following measures before and after the new inpatient physician program began: (1) hospital length of stay and total charges, (2) outcomes related to quality of care, (3) primary care physician satisfaction, and (4) housestaff satisfaction. Differences before and after initiation of the inpatient physician program were evaluated using multivariate analyses to adjust for patient differences and secular trends.

Results: There were 2265 patients discharged from the general medical service in the year following implementation of the inpatient physician program. Postintervention average length of stay decreased from 3.5 to 3.0 days ($P < .001$). In multivariate analyses, average length of stay was reduced by 0.3 days ($P = .008$), and total hospital charges were reduced an average of \$426 per admission ($P = .001$). In-hospital mortality rates, percentage of

patients discharged home directly, and 30-day readmission rates did not change significantly in the postintervention period. Satisfaction among primary care physicians was high, with 90% of those answering a survey responding that they would recommend a similar program to other primary care groups. Medical housestaff satisfaction with their educational experience also increased.

Conclusions: Implementation of an inpatient physician program at this institution significantly decreased resource utilization while maintaining or improving quality of care. Satisfaction with the program was high among primary care internists and housestaff.

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The general internist who follows and cares for patients across the continuum of care may be a vanishing breed.^{1,2} Many health maintenance organizations (HMOs) and other healthcare delivery systems have created or are considering developing programs in which all inpatient management is formally directed by hospital-based, "inpatient" physicians instead of by patients' primary care physicians.³⁻⁶ The advent of these programs has raised significant questions about patient care, physician specialization, and medical training and has led to abundant soul-searching in the medical literature.^{1,2,7,8}

Although descriptions of the development of inpatient physician programs have appeared in increasing numbers,^{1,2,4-6,9} few published articles contain a formal evaluation of their effectiveness.¹⁰⁻¹² Interpretation of these data is complicated by the prevailing strong secular trend throughout the country toward lower lengths of stay (LOSs).^{13,14} A single article in the peer-reviewed literature found that at one teaching hospital, patients cared for by full-time inpatient physicians had lower LOSs and hospital costs than did those cared for by physicians on a traditional academic medical service.¹⁵

In this article, we analyze results 1 year after an inpatient physician program was implemented by an HMO at a teaching hospital for the care of its general medicine patients. This program differs from others described in the literature in that it is not based on true "hospitalist" physicians¹⁵ but on general internists who maintain their primary care practices while serving intermittent rotations as inpatient physicians. The goals of our study were (1) to use multivariate models adjusting for potential secular trends and changes in patients' clinical characteristics over time to measure the impact of the program on utilization and quality of care and (2) to assess the satisfaction of primary care physicians (PCPs) and medical housestaff with the program.

... METHODS ...

Setting and Patient Population

This study was conducted within the adult patient population of a large staff-model HMO in Boston, MA, affiliated with Harvard Pilgrim Health Care. The staff-model HMO consists of 14 health centers, 8 of which admit their adult patients to Brigham and Women's Hospital (BWH), a 700-bed teaching hospital affiliated with Harvard Medical School. These 8 health centers care for an ethnically and socioeconomically diverse population drawn from the city of Boston and its surrounding suburbs. During the study there were approximately 146,000 adult members of the HMO, of whom approximately 12,000 were Medicare beneficiaries. All PCPs within this HMO are board-certified or board-eligible general internists.

For the purposes of this study we used the hospital administrative database to identify all patients belonging to the HMO who were discharged from the general medical service between June 1, 1994, and

May 31, 1996 ("baseline" years), and during the first year after the inpatient physician system was implemented (June 1, 1996, through May 31, 1997 ["postintervention" year]). The records of 14 patients with LOSs greater than 30 days were excluded to avoid skewing the data with extreme cases.

Baseline Admitting and Inpatient Care System

The HMO patients admitted to the general medicine service were assigned to 1 of 3 HMO housestaff teams consisting of a resident, 2 interns, a subintern, and a case management nurse. Each patient had an HMO internist functioning as the attending of record. All HMO internists were involved in hospital rounding and practiced in their offices on days when they had patients in the hospital. Thus, inpatient rounds by the attending were usually performed once daily in the early morning before office hours. All hospital orders were written by housestaff.

Attending educational rounds for the medical housestaff on the HMO medical teams were performed by 2 HMO "teaching attendings" who had no direct patient care responsibilities.

Inpatient Physician Program

Starting in June 1996, the care of all HMO general medicine patients was directed by an inpatient physician rather than by their own general internist. Admitting procedures and medical housestaff functions remained the same. The pool of 26 inpatient physicians was self-selected from the existing group of general internists and represented approximately 25% of the total general internists on staff at the 8 BWH-based health centers. All internists who indicated interest were allowed to participate in the program. Hospital rotations in the new inpatient physician program are 2 weeks long, with each physician spending, on average, a total of 6 weeks per year at the hospital. During these rotations, their office-based practice is covered by other general internists in their practice group. At any one time, 3 inpatient physicians are on service at BWH. No new physicians were hired for this purpose.

The inpatient physicians are responsible for all aspects of patient care and are expected to perform at least twice-daily patient assessments. Medical decision making and disposition planning are ongoing throughout the day. The inpatient physician is also responsible for resident and medical student teaching during structured attending and "walk"

rounds, and less formally at the bedside. As in the baseline system, all orders were written by the housestaff team. Communication with each patient's PCP is a daily responsibility, and the inpatient physician also dictates a STAT discharge summary into the ambulatory medical record for every hospitalized patient. Although outpatient general internists no longer function as attending physicians of record, some continue voluntarily to visit their patients and/or write notes in the hospital chart.

Outcome Measures and Data Sources

Hospital LOS, total hospital charges, *International Classification of Diseases, Ninth Edition* codes, and discharge diagnosis-related group (DRG) diagnoses were obtained from the BWH hospital database. All charges in the database were standardized to 1994 charges. Thirty-day readmission rates to the general medical service and in-hospital mortality rates were also obtained from hospital data sources.

Opinions regarding the inpatient physician program were gathered from primary care providers with the practice group through an anonymous written survey performed in early 1999. Satisfaction of the medical housestaff with teaching in the new program was evaluated through a weekly written survey given to all housestaff on the HMO medical teams. Surveys were handed out and collected during a small conference in a manner to ensure near 100% response rates.

Data Analysis

Bivariate differences between outcome measures from the preintervention and postintervention time periods were evaluated using the χ^2 statistic or the Student *t* test. To adjust for clinical factors and for the secular trend toward lower hospital LOSs, linear regression models were used that included (1) age, (2) sex, (3) clinical complexity as measured by a DRG weight assigned by the Health Care Financing Administration and clinical comorbidity as measured by a modified Charlson comorbidity index,¹⁶ and (4) the quarter of the calendar year in which the patient was discharged from the hospital. Linear regression models including calendar quarter are useful in analyzing the results of interrupted time series data because they effectively adjust for secular trends.¹⁷⁻¹⁹ Multivariate analyses with LOS and total charges as dependent variables were performed using regular and log-transformed dependent variables to assess for differences due to the nonnormality of the data. The distributions of LOS and total charge data were made more normal by log transfor-

mation, and so we report *P* values derived from the analyses of log-transformed dependent variables.

... RESULTS ...

Similar numbers of HMO patients were discharged from the general medical service during each of the 2 preceding baseline years (*n* = 2386 and 2133) and during the postintervention year (*n* = 2265). Table 1 displays a comparison of patient characteristics and quality-of-care indicators between the baseline years and the postintervention year. Compared with all baseline patients, postintervention patients were older on average (mean age, 59.2 vs 56.1 years; *P* < .001), but neither the mean DRG weight (0.99 vs 0.98, *P* = .62) nor the mean Charlson comorbidity index (1.42 vs 1.49, *P* = .15) changed significantly, suggesting that patients in the postintervention year were not significantly more or less clinically complex than were patients in the preceding baseline years.

Compared with baseline, the percentage of patients who died during hospitalization on the general medical service did not change significantly during the postintervention year (1.19% vs 1.37%, *P* = .64), and patients in the postintervention year were not significantly more likely to be discharged to a nursing home, rehabilitation facility, or location other than home (15.5% vs 14.8%, *P* = .54). The 30-day readmission rate of patients to the general medical service was 15% lower in the postintervention year compared with baseline (8.8% vs 10.3%, *P* = .13), but this difference did not reach statistical significance.

Length of Stay and Hospital Charges

Although clinical complexity, in-hospital mortality, and 30-day readmission rates remained unchanged, average hospital LOS fell significantly following implementation of the inpatient physician system (Figure). The crude average LOS during the 2 baseline years preceding the intervention was stable at 3.4 and 3.5 days, respectively. In the postintervention year, however, average LOS fell 13% to 3.0 days (*P* < .001). Multivariate regression analyses showed that the adjusted LOS was reduced from an average of 3.4 days during the baseline years to an average of 3.1 days during the postintervention year (*P* = .008).

Total hospital charges per admission averaged \$6474 and \$7382, respectively, during the 2 baseline years. During the postintervention year, total charges were \$7185 per admission. Multivariate analyses

Table 1. Patient Characteristics and Quality of Care Measures Compared Between Baseline Years and the Year After Implementation of a Hospitalist Program for the Care of Hospitalized General Medicine Patients

	Baseline 6/1/94–5/31/96 (n = 4519)	Postintervention 6/1/96–5/31/97 (n = 2265)	P
Mean age (y)	56.1	59.2	<.001
Female gender	2330 (51.6%)	1214 (53.6%)	.11
Mean DRG weight	0.98	0.99	.62
Charlson comorbidity index	1.49	1.42	.15
In-hospital mortality	62 (1.37%)	27 (1.19%)	.64
Discharge to site other than home	667 (14.8%)	350 (15.5%)	.54
30-d readmission rate	465 (10.3%)	199 (8.8%)	.13

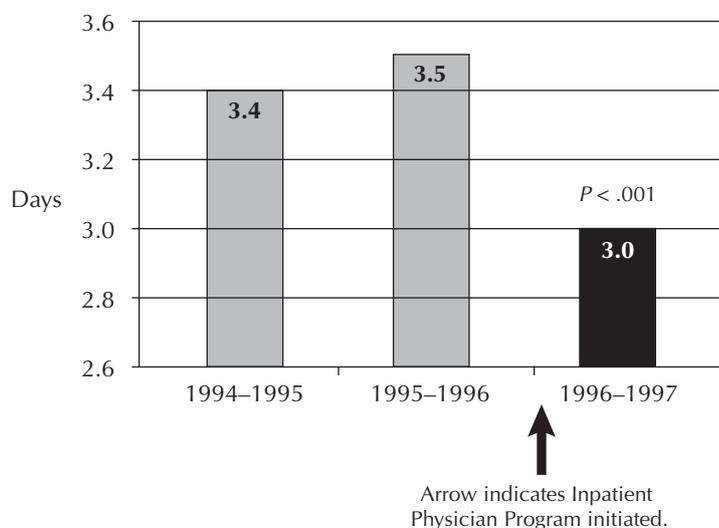
DRG = diagnosis-related group.

showed an average reduction in total charges of \$426 per admission during the postintervention period ($P = .001$). The reduction in cost was not found when LOS was added to the multivariate model, suggesting that reduced charges were caused by decreased LOS and not secondary to decreased use of professional or ancillary hospital services.

Medical Housestaff Satisfaction

The satisfaction of medical housestaff with their educational experience on the HMO medical service increased significantly in the postintervention period. Based on 49 responses obtained during the 3 months before the change, and 240 responses during the postintervention year, the average score for overall educational experience (graded on a scale from 1-4, with 4 being the highest) rose from 3.20 to 3.44 ($P = .04$). Informal feedback from the housestaff suggested that the major reasons for this improved satisfaction were the more cohesive team structure and real-time, practical teaching fostered by the presence of a hospital-based attending.

Figure. Average Length of Stay in the General Medical Service



Primary Care Physician Satisfaction

Of the 93 PCPs in the practice group, 56 (60%) responded to the mailed survey. Of the 56 respondents, 34 (61%) had become solely office based after the inpatient physician program began and 22 (39%) had served as inpatient physicians. The results of the survey are shown in Table 2.

Seventy-six percent of all respondents felt that the inpatient physician program had improved the quality of inpatient care, and 91% perceived the quality of outpatient care to be stable to improved.

Not surprisingly, 72% of PCPs who had become solely office based believed that their inpatient skills had diminished, whereas 77% of PCPs

servicing as inpatient physicians thought that their inpatient skills had improved. A majority of all PCPs (55%) perceived no change in their outpatient skills. The inpatient physician program was felt to have improved job satisfaction by 70% of PCPs, an opinion shared by a majority of PCPs whether they were solely office based or participated in the inpatient program. Finally, 90% of all PCPs, including 83% of office-based physicians, answered in the affirmative to the question "Would you recommend adoption of a similar program for other primary care medical groups?"

...DISCUSSION...

The burgeoning growth in the development of inpatient physician programs has been driven by continued pressure to contain healthcare costs and by recognition of the increasing complexity of the care of hospitalized patients.^{8,20} The theoretical benefits of delegating inpatient care to hospital-based physicians are several. Hospital-based (inpatient) physicians can offer comprehensive, on-site, and "real-time" involvement in medical decision

Table 2. Results of the 1998 Inpatient Physician (ie, "Rounder") Program Survey as Reported by HMO Internists

In your opinion, how has the Inpatient Rounder Program affected:	Much Improved	Slightly Improved	No Change	Slightly Worse	Much Worse
Overall quality of inpatient care?					
All	28 (51%)	14 (25%)	11 (20%)	2 (4%)	0 (0%)
Rounder	17 (81%)	3 (14%)	1 (5%)	0 (0%)	0 (0%)
Nonrounder	11 (32%)	11 (32%)	10 (30%)	2 (6%)	0 (0%)
Overall quality of outpatient care?					
All	13 (24%)	11 (19%)	26 (48%)	5 (9%)	0 (0%)
Rounder	7 (33%)	5 (24%)	8 (38%)	1 (5%)	0 (0%)
Nonrounder	6 (18%)	5 (15%)	18 (55%)	4 (12%)	0 (0%)
Continuity of patient care?					
All	12 (23%)	9 (17%)	17 (32%)	12 (23%)	3 (5%)
Rounder	8 (38%)	5 (24%)	7 (33%)	1 (5%)	0 (0%)
Nonrounder	4 (13%)	4 (13%)	10 (31%)	11 (34%)	3 (9%)
Your inpatient skills?					
All	13 (24%)	5 (9%)	10 (19%)	18 (33%)	8 (15%)
Rounder	12 (55%)	5 (22%)	2 (9%)	2 (9%)	1 (5%)
Nonrounder	1 (3%)	0 (0%)	8 (25%)	16 (50%)	7 (22%)
Your outpatient skills?					
All	8 (14%)	16 (29%)	31 (55%)	1 (2%)	0 (0%)
Rounder	3 (14%)	13 (59%)	6 (27%)	0 (0%)	0 (0%)
Nonrounder	5 (15%)	3 (9%)	25 (73%)	1 (3%)	0 (0%)
Your level of job satisfaction?					
All	19 (35%)	19 (35%)	10 (18%)	6 (11%)	1 (1%)
Rounder	11 (50%)	9 (41%)	2 (9%)	0 (0%)	0 (0%)
Nonrounder	8 (24%)	10 (31%)	8 (24%)	6 (18%)	1 (3%)
Would you recommend adoption of a similar Rounder Program for other primary care medical groups?					
	Yes	No			
All	44 (90%)	5 (10%)			
Rounder	20 (100%)	0 (0%)			
Nonrounder	24 (83%)	5 (17%)			

making for sick patients. Through training and experience, inpatient physicians may also become more expert than PCPs in the efficient hospital management of acute illness. However, some have feared that hospitalist and other inpatient physician programs will further segment patient care responsibility and may even compromise the quality and efficiency of care by losing the advantages that come from the deeper knowledge of patients held by PCPs.^{3,7,8}

In our study, we found that average LOS decreased significantly even when potentially confounding factors were taken into account. Other investigators have described similar decreases after the implementation of an inpatient physician system. At Henry Ford Hospital, Detroit, MI, initiation of an inpatient physician program coincided with a decrease in LOS from 7.6 to 6.6 days.¹⁰ In an article from the University of California at San Francisco, the introduction of a "managed care service" staffed by internists who attended more often with more active involvement produced a significant decrease in LOS compared concurrently with a traditional general medicine service.¹⁵ In this same study, patient satisfaction during hospitalization did not differ significantly between the 2 medical services. Diamond et al found that a hospitalist program decreased the cost of care and readmission rates, whereas LOS declines paralleled the control (non-hospitalist) groups.¹²

The fact that we found a reduction in average LOS when starting from a baseline of 3.4 to 3.5 days is notable given that reductions from this level might not be thought possible without seriously compromising the quality of care. Our findings, however, show that in-hospital mortality, discharge to extended care facilities, and 30-day readmission rates did not increase with the switch to an inpatient physician system. In addition, other key outcomes, including physician and medical housestaff satisfaction, were stable to improved.

There are several potential limitations to our findings. Chief among them is that this was not a randomized controlled trial and we cannot exclude the possibility of other contemporaneous changes in the management of hospitalized patients that might have reduced LOS. For example, a reduction in waiting times for transfer to chronic care facilities could also have produced decreases in LOS. We are unaware, however, of any such change in the system of care that might have shortened LOS. In fact, the only major simultaneous change in the hospital systems was more likely to bias our results toward finding no decrease in

LOS: concurrent with the start of the inpatient physician program, the BWH Emergency Department (ED) initiated an observation unit. Chart review indicates that during the first year of the inpatient physician program, approximately 20 cases per month who previously would have accounted for short (1-2 day) admissions were treated and released from the ED observation unit. Because these patients were not considered inpatients, they were excluded from our analysis. Finally, the setting of our intervention (a large urban teaching hospital) and the structure of our program (PCPs serving as hospitalists for several 2-week rotations per year) may limit the applicability of our results to other practice settings.

Could the improved efficiency of an inpatient physician program be solely because of the superior skills of the physicians selected for the program? Within any practice group there are likely to be physicians who are more efficient and skilled at inpatient care, and thus one of the generalizable benefits of any inpatient physician program may be that it identifies such physicians and gives them increased responsibility. Nonetheless, our inpatient physicians were not hired from the outside with special training or skills; they were self-selected from within the current group of practicing general internists. Furthermore, all internists who elected to participate were accepted into the program. Thus, the decline in LOS and hospital charges is more likely a reflection of training effect (smaller number of attendings on a full-time basis) and structure of attending involvement (all-day availability for diagnostic decisions, patient and family conferences). We did not have the data to evaluate differences in individual use patterns for internists who served as hospital attendings during the preintervention and postintervention periods. Further research on this point conducted at the time of a transition to a hospitalist program might shed light on our theory that "practice makes perfect" and program structure are the key factors to the efficiencies engendered.

Although some inpatient physician programs are staffed by true hospitalists who spend at least 25% of their total time devoted to inpatient care,²¹ there may be benefits to cultivating hospital expertise in internists who still see patients across the spectrum of care. Even though a body of evidence suggests that certain disease states are better managed by specialists,²²⁻²⁵ perhaps our model of an inpatient physician program represents a middle ground. In this model, "specialized generalists" who are adept at hospital management benefit from the outpatient

experience, broad clinical perspective, and communication skills nurtured in primary care. Thus, our variation on the hospitalist theme does not fit neatly into the 4-stage paradigm of hospital care outlined by Wachter.²⁶ Perhaps our inpatient physician program is closest to stage II, with the crucial difference being that only a small subset of the PCPs function in the hospitalist role. However, we believe that our inpatient attendings spend enough dedicated time in the hospital to engender the advantages enumerated for stages III and IV—honing of skills, attention to utilization, and quality improvement.

The solid outpatient physician acceptance of this major and somewhat controversial change in practice is likely attributable to the unrelenting efforts put into communication. Daily updates from the inpatient physician to primary care providers are mandatory, as are the STAT discharge summaries dictated into the outpatient medical record. Furthermore, our survey of PCPs provides evidence that physician satisfaction with an inpatient system can be high, even among physicians who become solely office based. Although there are pros and cons to having only a subset of internists perform as inpatient physicians, the positive physician response to the program suggests that similar models of inpatient care should be considered by other physician practices and healthcare delivery systems.

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