Post-call Transfer of Resident Responsibility:

Its Effect on Patient Care

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Objective: ***To determine whether transferring the care of patients to another senior resident the day after admission to the hospital adversely affects the efficiency and quality of care.***

Design: ***Retrospective analysis of a natural experiment.***

Setting: ***The general medical service of the Minneapolis Veterans Affairs Medical Center, a major tertiary teaching hospital of the University of Minnesota internal medicine residency program.***

Patients/participants: ***Subjects were all the patients admitted to the medicine service from 5:00 PM to 6:00 AM over an eight-month period.***

Intervention: ***After 5:00 PM, half of the patients were admitted to the hospital by a cross-covering senior resident (CC group of patients), and their care was transferred to a different senior resident the following day. The other patients were initially evaluated by the primary senior resident (PE group of patients). Assignment to the different services was a random, sequential process.***

Measurements and main results: ***The CC group had significantly more laboratory tests performed during their hospital stay than did the PE group of patients (44 vs. 32, $p = 0.01$), even when adjusted for length of stay. Using multiple linear regression to adjust for other clinical parameters including length of stay, DRG weight, and number of consults, the authors found that being a CC subject was a significant predictor of the number of laboratory tests obtained ($p = 0.01$). Furthermore, the median length of stay in the CC group ($n = 74$) was longer than that in the PE group ($n = 72$) (eight days vs. six days); this was of borderline statistical significance, using a two-sample median test ($p = 0.06$).***

Conclusion: ***Patients transferred to a different resident the day after admission had more laboratory tests performed and longer inpatient stays.***

Key words: ***continuity of care; resident education; use of hospital resources; laboratory testing; cost of care; transfer of care.*** **J GEN INTERN MED 1990;5:501–505.**

CONTINUITY is an important aspect of medical care. In the outpatient setting it has been shown to decrease health care costs, improve patient satisfaction, and possibly improve the quality of care.[1, 2] In a randomized trial of elderly men, increasing the continuity of outpatient health care was associated with a 50% decrease in the number of emergency admissions and a 40% decrease in the average length of hospital stay.[1] In addition, the continuity group of patients thought their physicians were more knowledgeable, thorough, and interested in patient education. Similarly, Cohen et al. found that improving the continuity of outpatient care was associated with a 26% decrease in total hospital charges and a 2.2-day decrease in the average length of hospital stay.[2]

The effect of physician continuity of care during the inpatient hospital stay has not been fully evaluated. At our institution, senior residents in internal medicine often assume the care of patients admitted to the hospital by "on-call" senior residents. This practice of assuming the care of patients admitted to the hospital by other on-call physicians is common to many different medical settings. Anecdotally, our residents state that they are never as comfortable with or as confident about the management of patients they did not initially evaluate.

Since the senior resident is often instrumental in major diagnostic and therapeutic decisions, we hypothesized that transferring the care of patients to another senior resident the day after admission could adversely affect the efficiency and quality of care. Specifically, we were interested in knowing whether transferring the care of patients to a different physician increases: 1) length of stay; 2) use of procedures and hospital resources; 3) incidence of morbid events; and 4) number of discharges to extended care facilities. To answer these questions we conducted a retrospective study of a natural experiment occurring in our residency training program. Half of the patients admitted to the hospital after 5:00 PM are initially evaluated by a "cross-cover" (CC) senior resident, and their care is transferred to the primary senior resident the following morning. The other patients are initially evaluated by the primary senior resident. Patient assignment to either type of service is a random event, thus giving rise to this "natural experiment."

METHODS

Setting

The study was conducted at the Minneapolis Veterans Affairs Medical Center (VAMC), a 711-bed urban teaching hospital affiliated with the University of Min-

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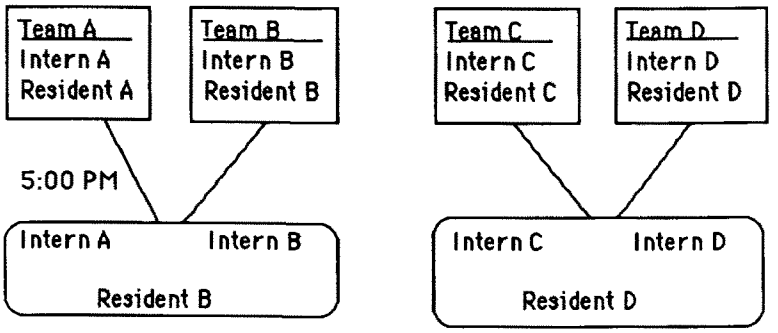

FIGURE 1. Scheme showing the call system. After 5:00 PM, patients admitted to intern A's service will be initially evaluated by resident B. The following morning, resident A would assume the care of all patients admitted by intern A. The "cross-cover" group of patients are those patients admitted by interns A and C. The care of these patients is transferred to the primary senior resident the following morning. The "primary evaluation" group of patients are those patients admitted to interns B's and D's services. These patients are initially evaluated by the primary senior resident; therefore, their care is not transferred.

nesota internal medicine residency training program. There are 210 beds on the medical service and more than 8,000 annual discharges.

Each of the four general medical wards is staffed by four housestaff teams, for a total of 16 teams. Each team consists of one intern, one senior resident, one attending physician, and one or two medical students. Each day one team from each of the four wards is on call for 24 hours (Fig. 1). After 5:00 PM, only two of the four senior residents, but all four of the interns, remain in the hospital on call. The two senior residents who remain in the hospital on call (residents B and D from the example in Fig. 1) will crosscover the interns and services of the two senior residents who went home (residents A and C). Thus, senior resident B would be responsible for patients admitted to both interns A and B after 5:00 PM. All patients are admitted to the medical service in a random, sequential manner. Therefore, half of the patients are admitted to a service with a primary senior resident, and half, to a service with a senior resident who is cross-covering that service.

On the morning following the on-call period, patients admitted to the hospital by the CC senior resident are transferred to the primary senior resident. Using the example in Figure 1, patients admitted to the hospital by intern A after 5:00 PM would be initially evaluated by resident B. The following morning, resident A would assume the care of all patients admitted by intern A. The CC group of patients are all the patients admitted after 5:00 PM to interns A and C, while the "primary evaluation" (PE) group of patients are those admitted by interns B and D.

The senior residents at the University of Minnesota training program rotated clinical services every six weeks throughout the study period. The interns rotated off the inpatient ward service at the Minneapolis VAMC one week before the residents changed services. Each resident was a CC resident one night and the primary resident the next call night. Therefore, there was a complete interchange of residents involved in the care of both groups of patients.

Patient Selection

We reviewed the hospital courses of all patients admitted to the internal medicine service from 5:00 PM to 6:00 AM during the study period from September 1, 1986, through April 30, 1987. This sampling strategy was chosen because the medical condition of patients admitted to the hospital during the daytime may vary significantly in chronicity and severity. In addition, elective daytime admissions are occasionally assigned to a specific service because the patient is known to either the resident or the attending physician. This type of selective assignment of patients to specific services does not occur after hours. To avoid any carry-over from possible daytime admissions, we included only patients who first presented to the emergency area after 5:00 PM and were admitted. Patients who presented to the hospital before 5:00 PM but were admitted after 5:00 PM were not included. This method of patient selection resulted in a smaller but probably more uniform group of patients to study. Patients were excluded from analysis if they were subsequently transferred to a non–internal medicine service, were transferred to another hospital, had been recently discharged and readmitted within a two-week period, or did not have medical records available for review. The patients were identified using the hospital computer database.

Data Collected

The medical records were reviewed by a single research assistant who was blinded to the patients' group assignments. Data concerning the clinical characteristics, demographic information, initial vital signs, sodium, albumin, and creatinine values, numbers of discharge diagnoses, and medications and DRG weights were collected to examine the comparability of the CC and PE groups of patients. The costs of care of the two groups were compared by examining the lengths of stay and use of hospital resources.[2] The length of stay was abstracted from the medical record. To assess the use of hospital resources we counted the total numbers of x-rays, special diagnostic procedures, and laboratory tests that were performed. The only laboratory panels done at our institution are complete blood counts and electrolytes and fluid analyses (such as urinalysis or pleural fluid analysis). All other laboratory tests must be individually ordered. Each laboratory test or laboratory panel was counted as one laboratory test. There was no attempt to adjust or weigh the labora-

tory tests according to their relative expenses. The outcomes of care of the two groups were compared by examining the frequencies of in-hospital mortality, nosocomial fever, and discharge to chronic care facilities.

Analysis

To compare groups, we used the chi-square test for categorical variables and student's t-test for continuous variables. Two-tailed tests with significance level of 0.05 were used. Since the length of stay was not normally distributed, we compared median values using a two-sample median test. To assess the independent contribution of the patient group assignment (either CC or PE) in predicting the use of health care resources, we used a stepwise multiple linear regression model.

RESULTS

One hundred ninety-two patients were admitted to the medical service during the study period. Forty-six individuals were excluded from the analysis; 24 were transferred to a non-internal medicine service, five were transferred to another hospital, eight were readmissions, and the medical records were not available for nine. Of the remaining 146 eligible patients, 72 were admitted by the PE senior resident and 74 were admitted by a CC senior resident.

TABLE 1

Clinical Characteristics of the Primary Evaluation (PE) and the Cross-cover (CC) Groups of Patients

	PE Group	CC Group
Initial examination		
Systolic blood pressure—mean (SD)	126 mm Hg (21)	136 mm Hg (30)*
Heart rate—mean (SD)	84/min (14)	85/min (16)
Respiratory rate—mean (SD)	22/min (6)	22/min (7)
Temperature > 101°F	9%	13%
Initial laboratory data		
Albumin—mean (SD)	3.5 g/dL (0.6)	3.4 g/dL (0.5)
Creatinine—mean (SD)	1.4 mg/dL (1.1)	1.5 mg/dL (1.3)
Sodium—Mean (SD)	137 mmol/L (5)	137 mmol/L (6)
Discharge status		
Number of discharge diagnoses—mean (SD)	7.1 (2.9)	6.4 (3.4)
DRG weight—mean (SD)	90 (32)	98 (40)
Number of medications—mean (SD)	7.6 (3.8)	7.0 (3.5)

*The difference between the PE and CC groups of patients was statistically significant ($p < 0.05$).

TABLE 2

Use of Hospital Resources of the Primary Evaluation (PE) and the Cross-cover (CC) Groups of Patients

Resource—mean (SD)	PE Group	CC Group
Consults	0.8 (1.1)	0.9 (1.0)
Procedure	0.6 (0.9)	0.8 (1.1)
X-rays	2.8 (4.0)	2.8 (2.2)
Laboratory tests	32 (33)	44 (38)*
Laboratory tests/day	4.5 (2.4)	5.4 (2.4)†

*The difference between the PE and CC groups of patients was statistically significant ($p < 0.01$).

†The difference between the PE and CC groups of patients was statistically significant ($p = 0.03$).

Comparability

The clinical characteristics of the patients admitted to the hospital by either the PE or the CC senior resident are listed in Table 1. On initial examination, the CC group had a significantly higher mean systolic blood pressure than did the PE group. However, there was no statistically significant difference in other vital signs or initial laboratory values. The numbers of discharge medications and diagnoses and average DRG weights were similar between the groups. "Do not resuscitate" (DNR) orders were written for 28% of the PE group, versus 20% of the CC group. Again, this difference was not statistically significant.

Use of Hospital Resources

Table 2 lists the use of resources by each group. Patients admitted by a CC senior resident had 40% more laboratory tests performed during their hospital stays than did the PE group. This increased use of laboratory tests persisted after adjustment for the difference in lengths of stay. The CC group of patients averaged about 20% more laboratory tests per day than did the PE group.

We used a multiple linear regression model to assess the independent contributions of various clinical parameters in predicting the numbers of laboratory tests performed. Parameters entered into the model included fever, DNR status, origin of the patient, DRG weight, length of stay, group assignment, number of consults, systolic blood pressure, and creatinine and serum sodium levels. Only four factors were identified as being independent predictors, namely, DRG weight, length of stay, number of consults, and group assignment (CC versus PE). After adjusting for the length of stay, DRG weight, and number of consults, group assignment was still an independent predictor of the number of laboratory tests that were obtained. This model was able to account for nearly 50% of the observed variance.

The median lengths of stay were seven days and nine days for the PE and CC groups, respectively. Using

a two-sample median test, this difference was of borderline statistical significance ($p = 0.06$). The average length of stay for the PE group was 7.1 (± 5.3) days, compared with 8.3 (± 5.2) days for the CC group.

Patient Outcomes

No significant difference in patient outcomes was detected. The in-hospital mortality rates were the same —4% and 3% for the PE and CC groups, respectively. The numbers of patients discharged to nursing homes did not differ between the PE and CC groups — 29% and 31%, respectively. The frequency of new fever in the CC group was twice that of the PE group (13% and 6%, respectively). This difference, however, did not reach statistical significance ($p = 0.13$).

DISCUSSION

Patients whose care was transferred to another physician following the initial history and physical examination used more hospital resources. This transfer of care was associated with a 33% increase in the median length of stay, a 40% increase in the use of total laboratory tests, and a 20% increase in the number of laboratory tests per hospital day. Patient outcomes (death, nosocomial infection, and use of chronic care facilities) did not differ. New fevers were twice as common in the CC group of patients than in the PE group. However, given our sample size and the relatively rare occurrence of this untoward event, the finding failed to reach statistical significance.

With this natural experiment, the CC and PE groups of patients should be comparable. The patients were admitted to the two types of services in a random, sequential manner. As expected, the clinical characteristics of the two groups were similar (Table 1).

There are several possible explanations for the increased use of hospital resources by the CC group of patients. First, the increased use of laboratory tests may be due to a "consultant effect."[3] Rudd et al. found that consultants frequently identified other medical problems and that 41% of tests ordered by the consultant were unrelated to the primary problem.[3] The number of diagnostic considerations tends to increase as additional physicians evaluate a given patient. The primary physician who assumes the care of a CC patient will render a second opinion and may expand or alter the original differential diagnosis. Altering the differential diagnosis may generate additional diagnostic studies not ordered by the CC resident.

A second possibility is that disruption of the physician–patient relationship may delay the patient's response to therapy, resulting in a longer length of stay and an increased use of laboratory tests. An important part of the physician–patient relationship is often established during the initial evaluation. To be maximally effective, the physician must understand the patient's priorities and expectations.[4, 5] Patients report better outcomes when there is physician–patient agreement about the illness.[6] Open communication and trust between the patient and the physician may not occur when the patient and/or physician realize that the relationship is not going to continue. Similarly, the physician assuming the care may not take the opportunity to foster the physician–patient relationship since the task of collecting the historical information has already been completed.

The initial interview can be therapeutic.[7] Through the use of support, legitimization, partnership, and respect, the physician can help alleviate these aspects of illness.[8, 9] Attending to the psychosocial needs of the patient has been shown to improve patient satisfaction, compliance and functional status, and the cost–effectiveness of care.[8] This information may also help expedite the patient's discharge planning. Interrupting the physician–patient relationship by transferring the patient's care to a different senior resident may undermine the therapeutic aspects of the relationship and thereby prolong the hospital stay.

Finally, it is possible that physicians are not as knowledgeable about a patient unless they have personally conducted the initial evaluation. The casual observation by our residents that they never "really knew the patient" unless they had done the initial history and physical examination was one of the original motives to conduct this study. These data are consistent with that observation.

The combination of the history and the physical examination is the preeminent source of diagnostic information.[10] In 630 medical consultations, Sandler found that the medical history determined the correct diagnosis in 56% of cases, and the physical examination, in another 17%. Technology-based information (i.e., clinical laboratory tests and imaging studies) was essential for the diagnosis in only 23% of cases.[11] A study of medical students found similar results, where 62% of the information needed for the diagnosis was found in the history.[12] Residents and faculty also view the patient history as the key source of diagnostic information. In a study of internal medicine residents, the perceived value of the history increased over the course of training.[10] If this rich source of diagnostic information is diminished, physicians may try to compensate by ordering more laboratory tests. This possibility would explain the finding of the increased use of tests for the CC group of patients.

A potential concern is that the less frequent use of laboratory tests may adversely affect patient outcomes. With this retrospective review, our ability to examine many important patient outcomes was limited. We could not assess long-term outcomes such as missed diagnoses, functional status, or perceived quality of

life. However, rates of in-hospital mortality and the use of chronic care facilities did not differ, and the incidences of nosocomial fever tended to favor the PE group of patients. Though it is encouraging that the less frequent use of hospital resources was not associated with an obvious difference in quality of care, the aforementioned untoward events were infrequent, so the power of this study was limited. Several other investigators, however, have also shown that organizational interventions can significantly decrease the use of hospital resources without adversely affecting the quality of care.[2, 13-16] Diagnostic tests account for approximately 25% of total health care expenditures,[17] and often appear to be discretionary or unnecessary.[14] Therefore, it is not surprising that one can significantly reduce laboratory testing without affecting quality of care.

In recent years there has been increasing concern among physicians and the public about the effect of working conditions on the performance of resident physicians. This concern has generated new guidelines[18-20] and legislation in at least one state,[21] limiting the number of hours a resident may work each week. Many training programs have responded by altering their on-call schedules. These data show that interrupting the inpatient continuity of care may affect the use of hospital resources and the quality of patient care. As training programs evolve and modify their call systems, every effort should be made to maintain the sanctity of the resident-physician–patient relationship. In addition, as changes are implemented it is important that programs critically evaluate the effect of these changes on patient care.

This study was conducted at a single institution and needs to be replicated in a variety of other clinical settings. The transfer of care from one physician to another physician after the initial evaluation is common practice in not only teaching hospitals but many community hospitals as well. Many physicians practicing in the community "share call" with other physicians in their group. Thus, transferring care from an on-call physician who has admitted the patient to the hospital during a night or weekend to the primary physician is a frequent occurrence, especially in larger group practices. If the association between the use of hospital resources and the continuity of care during the hospital stay observed in this study is found to be true in other clinical settings, the financial and clinical implications may be substantial. Our study suggests that efforts to minimize the fragmentation of care during the hospital stay could significantly decrease costs by lowering the use of hospital resources without adversely affecting patient care.

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