



Procedures Performed by Hospitalist and Non-hospitalist General Internists

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BACKGROUND: In caring exclusively for inpatients, hospitalists are expected to perform hospital procedures. The type and frequency of procedures they perform are not well characterized.

OBJECTIVES: To determine which procedures hospitalists perform; to compare procedures performed by hospitalists and non-hospitalists; and to describe factors associated with hospitalists performing inpatient procedures.

DESIGN: Cross-sectional survey.

PARTICIPANTS: National sample of general internist members of the American College of Physicians.

METHODS: We characterized respondents to a national survey of general internists as hospitalists and non-hospitalists based on time-activity criteria. We compared hospitalists and non-hospitalists in relation to how many SHM core procedures they performed. Analyses explored whether hospitalists' demographic characteristics, practice setting, and income structure influenced the performance of procedures.

RESULTS: Of 1,059 respondents, 175 were classified as "hospitalists". Eleven percent of hospitalists performed all 9 core procedures compared with 3% of non-hospitalists. Hospitalists also reported higher procedural volumes in the previous year for 7 of the 9 procedures, including lumbar puncture (median of 5 by hospitalists vs. 2 for non-hospitalists), abdominal paracentesis (5 vs. 2), thoracenteses (5 vs. 2) and central line placement (5.5 vs. 3). Performing a greater variety of core procedures was associated with total time in patient care, but not time in hospital care, year of medical school graduation, practice location, or income structure. Multivariate analysis found no independent association between demographic factors and performing all 9 core procedures.

CONCLUSIONS: Hospitalists perform inpatient procedures more often and at higher volumes than non-hospitalists. Yet many do not perform procedures that are designated as hospitalist "core competencies."

KEY WORDS: hospitalists; non-hospitalists; procedures; time-activity criteria.

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INTRODUCTION

Bedside procedures have traditionally been a core feature of internal medicine. However a recent survey showed a 50% decline in the number of procedures performed by internists compared to data from 16 years earlier.¹ Many reasons for this trend have been proposed, including increased regulatory oversight of procedures; advances in non-invasive diagnostic and therapeutic interventions; and greater availability of procedure-oriented subspecialists.² During this same time period, the traditional internal medicine practice model has largely separated into practice concentrated in either outpatient or inpatient settings³. Although outpatient-based internists may perform fewer bedside procedures, hospitalists may remain highly engaged in these activities.

Comfort and confidence with bedside procedures are deemed a necessary skill for hospitalists⁴. The Society of Hospital Medicine (SHM), the national society for hospitalists, and other inpatient medical practitioners, has endorsed a curriculum for hospital medicine that labeled 9 bedside procedures as *core competencies*.⁵ Little is known about which procedures are actually performed by hospitalists. We conducted this analysis to: i) describe the type and frequency of the inpatient procedures performed by hospitalist physicians, ii) determine if hospitalists performed more of these procedures than non-hospitalists, and iii) examine which characteristics are associated with the performance of the procedures.

METHODS

Study Design

We analyzed data from a previously described national survey mailed to 2,500 members of the American College of Physicians (ACP) mailed in 2004.¹ In this survey, respondents were

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asked whether they had performed any of 40 different procedures in the previous year. For the procedures they had done, respondents were also asked to estimate the actual number they had performed. For each procedure, a small minority of respondents did not estimate their procedural volumes, even though the indicated that they performed that procedure.

Definition of a Hospitalist

After consulting with colleagues in hospital medicine and reviewing definitions used in prior studies,⁶⁻¹⁰ we defined hospitalists as respondents who spent more than 10 hours per week in clinical activity and who also spent more than 40% of their clinical time in hospital-based activity. The threshold for a minimum number of clinical hours per week was set in order to ensure that the physicians who were classified as hospitalists were routinely engaged in clinical work and not predominantly acting as educators, researchers, or administrators. The 40% cut-off for clinical time spent in hospital care was selected because it fell within the range of time allocation used in prior studies,^{6,7,10} and it was hypothesized that this limit would provide balance between identifying hospitalists with specificity and offering an adequate sample size for analysis. The 10-hour and 40% thresholds were determined prior to analyzing the data.

Inpatient Procedures

We evaluated 9 of the 40 procedures assessed in the 2004 ACP survey. These nine have been designated as *core competencies* by the SHM curriculum for hospitalists: electrocardiogram interpretation, chest X-ray interpretation, arthrocentesis, thoracocentesis, abdominal paracentesis, lumbar puncture, central line placement, endotracheal intubation, and ventilator management.⁵

Data Analysis

Comparisons were made between physicians classified as hospitalists and non-hospitalists with respect to whether they performed the 9 procedures in practice. To explore the impact of covariates, hospitalists' procedural activities were stratified by respondents' clinical work time, their year of graduation from medical school (before 1986 versus 1986 and later), the population of the respondent's community (greater or fewer than 25,000 people), hospital size (greater or fewer than 250 beds), and income structure (fixed salary, income based on <50% clinical productivity, or income based on >50% clinical productivity). Ordinary least squares regression was used to evaluate for independent contributions of demographic and practice variables to performance of all 9 hospitalist procedures. Bivariate samples were compared using Kruskal-Wallis one way analysis of variance for continuous variables, and Fisher exact test for categorical variables. As our analysis included multiple comparisons, we used Bonferroni adjustment to minimize the risk of falsely assigning significance to differences, and set a cut-off for statistical significance at $P \leq 0.001$ for all comparisons.

All statistical analyses were performed using SAS software (SAS Institute Inc., Cary, North Carolina). This analysis was part of a study approved by the institutional review board of the University of Nebraska Medical Center (322-00-EX).

RESULTS

Characteristics of survey respondents have been described earlier.¹ Of the 2,500 questionnaires mailed, 2,476 had valid addresses, and 1,389 (56%) were returned. Ninety-six physicians were excluded because they had retired from active practice (n=56), or because they did not complete the survey (n=40). Of the 1,293 remaining respondents, 234 were excluded because they indicated that their practice was in a subspecialty of medicine. Out of the remaining 1,059 respondents, 175 met the criteria for classification as hospitalists. The remaining 884 respondents were classified as non-hospitalists.

The characteristics of those classified as hospitalist and non-hospitalist physicians are shown in Table 1. Both hospitalists and non-hospitalists worked a median 50 hours per week in patient care (interquartile ranges [IQR], 36-60 hours per week, $P=0.32$). Those classified as hospitalists spent more time in hospital-based patient care than did non-hospitalist physicians (median 40 vs. 5 hours per week, $P<0.001$). Nearly half (44.6%) of physicians classified as hospitalists performed all of their patient care activities in the hospital setting, while on average they allocated a median 80% (IQR 50%-100%) of clinical activities to hospital care. No significant differences existed between physicians classified as hospitalists and non-hospitalists in terms of year of medical school graduation, population of practice location, or hospital size.

Procedures Performed by Hospitalists Versus Non-hospitalists

Performance of SHM core procedures by hospitalist and non-hospitalist physicians is shown in Table 2. Eleven percent of

Table 1. Characteristics of 1,059 Hospitalist and Non-hospitalist Respondents

Characteristic	Hospitalists (N=175)	Non-hospitalists (N=884)	P-value:
Year of med school graduation			
Before 1986—N (%)	88 (50)	504 (57)	0.11
1986 or later—N (%)	87 (50)	380 (43)	
Practice site			
Large city (pop. ≥25,000)—N (%)	149 (85)	711(80)	0.16
Small city/Rural (pop. <25,000)—N (%)	26 (15)	173 (22)	
Hospital size			
>250 beds—N (%)	103 (60)	402 (49)	0.02
≤250 beds—N (%)	70 (40)	412 (51)	
Hours/week in patient care—median (IQR)	50 (36-60)	50 (36-60)	0.32
Hours/week in hospital practice—median (IQR)	40 (20-50)	5 (1-10)	< 0.001 ^a
Proportion patient care in hospital practice—median (IQR)	0.8 (0.5-1)	0.13 (0.02-0.2)	< 0.001 ^a
Respondents who spend time exclusively in the:			
Hospital setting—N (%)	78 (44.6%)	2 (0.2%)	< 0.001 ^a
Non-hospital setting—N (%)	0 (0%)	199 (23.7%)	< 0.001 ^a

^aP value remains statistically significant after Bonferroni correction

Table 2. Core Competency Procedures Performed in Practice by Hospitalists and Non-hospitalists

	Respondents who performed procedure in past year N (%)		P value	Procedures performed in past year Median (IQR)				P value
	Non-hospitalists N=884	Hospitalists N=175		N ^b	Non-hospitalists	N ^b	Hospitalists	
Core Competency Procedures								
Electrocardiogram interpretation	829 (94)	153 (87)	0.006	686	200 (100-500)	124	135 (100-382.5)	0.55
Joint injection/aspiration	461 (52)	105 (60)	0.07	396	20 (10-50)	89	10 (4-20)	<0.001 ^a
Chest X-ray interpretation	430 (49)	100 (57)	0.05	358	80 (30-150)	83	100 (50-200)	<0.001 ^a
Lumbar puncture	196 (22)	88 (50)	<0.001 ^a	174	2 (1-5)	76	5 (3-15)	<0.001 ^a
Abdominal Paracentesis	194 (22)	85 (49)	<0.001 ^a	176	2 (0-3)	74	5 (3-10)	<0.001 ^a
Thoracentesis	173 (20)	77 (44)	<0.001 ^a	155	2 (0-5)	65	5 (2-10)	<0.001 ^a
Central line placement	117 (13)	69 (39)	<0.001 ^a	109	3 (1-6)	58	5.5 (2-30)	<0.001 ^a
Endotracheal intubation	115 (13)	54 (31)	<0.001 ^a	103	2 (0-8)	43	10 (3-20)	<0.001 ^a
Ventilator Management	204 (23)	74 (42)	<0.001 ^a	178	10 (3-20)	64	20 (10-50)	<0.001 ^a
Respondents performing all 9 Hospital Procedures	29 (3)	19 (11)	<0.001 ^a					

IQR = interquartile range

^aP value remains statistically significant after Bonferroni correction

^bNot all respondents who indicated they did a procedure in their practice also estimated how many they performed in the past year.

physicians classified as hospitalists performed all 9 SHM core procedures, compared with 3% of those classified as non-hospitalists ($P<0.001$). Hospitalists performed less than a median of 6 central line placements, thoracenteses, paracenteses, or lumbar punctures in the previous year.

Factors Associated with Performing Procedures

As shown in Table 3, physicians classified as hospitalists performed a median of 4 (IQR 2-6) of the 9 SHM core procedures. In univariate analysis, hospitalists who practiced

Table 3. Number of Different Procedures among the 9 Core Competency Procedures Performed in Practice by the 175 Hospitalists

Characteristic	Hospitalists N (%)	Core procedures Median (IQR)	P-value
All hospitalists	175 (100)	4 (2-6)	—
Total hours in patient care			
1st quartile 0-44 hr	44 (25)	3 (1-6)	<0.001 ^a
2nd quartile 45-54 hr	36 (21)	5 (2-6.5)	
3rd quartile 55-64 hr	61 (35)	4 (2-6)	
4th quartile, ≥65 hr	34 (19)	4 (2-8)	
Hours spent in hospital care			
0-20 hr	45 (26)	3 (2-6)	0.12
21-35 hr	38 (22)	3.5 (2-6)	
36-48 hr	45 (26)	5 (2-7)	
≥49 hr	47 (27)	5 (2-7)	
Year of medical school graduation			
Before 1986	88 (50)	4 (2-6)	0.58
1986 or later	87 (50)	5 (2-7)	
Practice location			
Large city (≥25,000 pop.)	149 (85)	4 (2-6)	0.12
Small city/Rural (<25,000 pop.)	26 (15)	5 (2-7)	
Size of hospital			
<250 beds	70 (40)	4 (2-7)	0.57
≥250 beds	103 (60)	4 (2-6)	
Income			
Fixed salary only	82 (47)	5 (2-6)	0.002
<50% salary based on clinical productivity	29 (17)	6 (4-7)	
>50% salary based on clinical productivity	63 (36)	3 (1-5)	

^aStatistically significant after Bonferroni correction

more than 45 hours per week reported performing more core procedures than those who were less clinically active ($P<0.001$). A similar but non-significant trend in performing more core procedures was also seen among hospitalists who spent more time in hospital care.

Hospitalists with fixed salaries and those with <50% of their incomes based on clinical productivity performed more core procedures than those with greater productivity incentives, but this trend was non-significant after Bonferroni adjustment ($P=0.002$). No independent predictors for performing all 9 core procedures were found after controlling for time spent in patient care, time spent in hospital care, year of medical school graduation, practice location, hospital size, and income source (data not shown).

DISCUSSION

In 2004, Wigton and Alguire surveyed general internists about whether they perform 40 bedside procedures and compared the results with a survey they conducted 16 years earlier.¹ They found that a minority of respondents performed procedures, and that this proportion had declined significantly since their earlier survey. In analyzing the data further, we found that although physicians classified as hospitalists did perform more SHM core competency procedures than those classified as non-hospitalists, only 11% engaged in these activities. Furthermore, many of those who performed any procedure reported only performing a handful in the prior year.

These data show that physicians classified as hospitalists do not routinely perform all the SHM core competency procedures. The dataset used in this study allows for only a cursory examination of factors associated with performing procedures, but several reasons might explain why hospitalists do not perform more procedures. First, invasive diagnostic procedures may be less necessary with advances in clinical decision-making tools and diagnostic imaging techniques. Second, hospitalists may prefer to focus on cognitive and relational tasks, and refer their patients to procedurally-oriented colleagues, such as internal medicine subspecialists, interventional radiologists, surgeons or non-physician providers. Third, reimbursement and relative value unit (RVU) credit for these

procedures may not be in line with the time required to perform them. This hypothesis is partially supported by the suggestion in our analysis that hospitalists whose incomes were less strongly tied to clinical productivity (salaried or <50% based on clinical productivity) performed a wider variety of core procedures than those whose incomes were more strongly tied to productivity incentives.

If confirmed in subsequent studies, these exploratory findings have important implications for the how hospitalist practices are organized. For example, a study of an urban teaching hospital has reported that over a third of inpatient procedures are performed between 5 pm and 8 am.¹¹ If this is true for other organizations, the finding that few hospitalists engage in bedside procedures raises concern that diagnostic and therapeutic procedures may be delayed among patients admitted during non-standard hours.

Hospitals may also wish to improve weekend and around-the-clock access to procedural specialists, as dedicated proceduralists would have sufficient procedural volume to perform them with greater efficiency and effectiveness,² and it is known that higher volumes are associated with better outcomes across a wide range of procedures and conditions.^{12,13} Indeed societal trends are accelerating the need for dedicated proceduralists, as some hospitals have elected to not credential hospitalists and other internists for moderate-risk procedures, such as thoracenteses and central line placement.¹⁴

Even if timely access to procedural specialists were assured, there still are good reasons for hospitalists to perform bedside procedures. First, academic hospitalists are increasingly involved in resident education. Thus it is important that they perform enough procedures to adequately role-model, teach, and supervise trainees. Second, workforce studies predict an impending shortage of general surgeons,^{15,16} while procedural specialists such as interventional radiologists often offer services only during daytime hours (8 am to 5 pm). Hospitalists' around-the-clock availability positions them perfectly to provide procedural services in a timely manner, thus facilitating delivery of efficient, high-quality care. Finally, new technologies, such as bedside ultrasound, may make procedures such as central line placement and thoracentesis easier to learn, and safer to perform by hospitalists.^{17,18}

Several limitations of this study should be considered. First, this study relied on self-reported data and not direct observation. Second, all respondents were members of the ACP, which represents a broad, diverse group of internists. Although prior surveys report that nearly 90% of hospitalists trained in internal medicine,⁶ the absence of responses from non-ACP member hospitalists and those trained in family medicine or pediatrics may limit the generalizability of the results. Additionally we used the results of a 2004 survey, which may not reflect current practice patterns in this rapidly evolving specialty. While it may be preferable to survey the current membership of SHM on their procedural practices and related issues, this group has been fairly resistant to being surveyed, as evidenced by a response rate of only 24% to a recent membership survey.¹⁹ The findings of this secondary data analysis may substantiate the need for a more comprehensive exploration of the issues raised in this study. Fourth, we used a relatively complicated method to distinguish hospitalists from non-hospitalists. A review of previously published definitions of hospitalists found wide variation in the way hospital-

ists have been defined in the empiric literature.^{6-10,20} Our definition was chosen to balance sensitivity and specificity for identifying "true hospitalists" while still providing an adequate sample size for analysis. Nevertheless, it is possible that some respondents were misclassified. Fifth, our response rate of 56% was modest. We found no differences between respondents and non-respondents in terms of mean age or sex, but the potential for response bias remains an important concern. Finally, our secondary data analysis was limited to only those questions asked in the original survey, so we could not examine clinical outcomes nor could we assess potential confounders such as respondents' comfort with performing procedures, workload, access to specialty services, or patient population. These issues may be explored in future studies.

This study advances what is known about the bedside procedures performed by physicians who devote most or all of their clinical efforts to inpatient medical practice. There is a relatively low frequency with which physicians classified as hospitalists engage in the *core competency* procedures of hospital medicine. Balancing safety and efficiency against availability for performing requisite procedures on hospitalized patients is an issue that deserves additional thought and empiric research.

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