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ORIGINAL RESEARCH

Where Did the Day Go?—A Time-Motion Study of Hospitalists

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BACKGROUND: Within the last decade hospitalists have become an integral part of inpatient care in the United States and now care for about half of all Medicare patients requiring hospitalization. However, little data exists describing hospitalist workflow and their activities in daily patient care.

OBJECTIVE: To clarify how hospitalists spend their time and how patient volumes affect their workflow.

DESIGN: Observers continuously shadowed each of 24 hospitalists for two complete shifts. Observations were recorded using a handheld computer device with customized data collection software.

SETTING: Urban, tertiary care, academic medical center.

RESULTS: Hospitalists spent 17% of their time on direct patient contact, and 64% on indirect patient care. For 16% of all time recorded, more than one activity was occurring simultaneously (i.e., multitasking). Professional development, personal time, and travel each accounted for about 6% of their time. Communication and electronic medical record (EMR) use, two components of indirect care, occupied 25% and 34% of recorded time respectively. Hospitalists with above average patient loads spent less time per patient communicating with others and working with the EMR than those hospitalists with below average patient loads, but reported delaying documentation until later in the evening or next day. Patient load did not change the amount of time hospitalists spent with each patient.

CONCLUSIONS: Hospitalists spend more time reviewing the EMR and documenting in it, than directly with the patient. Multi-tasking occurred frequently and occupied a significant portion of each shift. ***Journal of Hospital Medicine*** **2010;5:323–328.** © *2010 Society of Hospital Medicine.*

KEYWORDS: hospitalists, quality improvement, time-motion.

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Hospital Medicine represents the fastest-growing specialty in the history of medicine in the United States, with approximately 28,000 hospitalists now working in over half of American hospitals.[1] Hospitalists increasingly fill the gap between demand for care of hospitalized patients and the deficit of physicians previously available—primary care physicians in community hospitals and residents in teaching hospitals.[2,3] This growth has also been driven by hospitalists' ability to increase clinical efficiency. Research consistently demonstrates a reduction in overall costs and length of stay with the use of hospitalists.[4–7] Additionally, many teaching hospitals have implemented nonteaching hospitalist services in an effort to comply with the Accreditation Council for Graduate Medicine Education (ACGME) program requirements regarding resident duty hours.[8] Given the potential for improved clinical efficiency and the need to comply with revised ACGME program requirements, the Hospital Medicine Service at Northwestern Memorial Hospital (NMH) was established in 2003. Today, this service cares for more than half of hospitalized medical patients at NMH.

Although extensive research documents that implementation of a hospitalist program improves the efficiency of hospital care delivery,[4,6] there is little data to explain how hospitalists achieve this level of efficiency or how efficiency might be increased further. Several authors have suggested potential explanations for hospitalists' efficiency gains, but none has yet received strong empirical validation.[5,7] The only previously published study to directly observe more than a small portion of the activities of hospitalists was conducted at NMH in 2006.[9] O'Leary et al. used time-motion methodology to study ten hospitalists for 75 hours total. They found that hospitalists spend a large amount of time on communication when compared to nonhospitalist physicians. However, the study only reported partial information about how and with whom this communications was performed. Similarly, the authors reported that documentation occupied about a quarter of hospitalists' time, but did not report more detailed information about what was being documented and how. Additionally, they noted that hospitalists spent 21% of their time multitasking, but did not report what types of activities were performed during these episodes. Finally, at the time of that study hospitalists at NMH saw about 40% fewer patients per day than they do now. Increasing the number of patients each physician sees in a day is an

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obvious way to increase productivity, but it is unclear how this affects hospitalist workflow and time spent in various clinical activities.

Another important trend in hospital care delivery is the implementation of electronic medical records (EMR).[10] NMH was just transitioning to a fully integrated EMR and computerized physician order entry (CPOE) system when the previous time-motion study was performed. Now that the system is in place, a significant proportion of hospitalists' time has shifted from using a paper-based record to sitting in front of a computer. However, we do not know exactly how hospitalists interact with the EMR and how this alters workflow; an increasingly important issue as hospitals across the U.S. implement EMRs at the behest of the federal government and aiming to improve patient safety.[11]

To better understand the workflow of hospitalists and validate the findings of the O'Leary study in a larger sample of hospitalists, we undertook this study seeking to collect data continuously for complete shifts, rather than sampling just a few hours at a time. We hypothesized that this would reduce observer effects and provide us with a more complete and accurate assessment of a day in the life of a hospitalist.

Methods

Study Site

The study was conducted at NMH, an 897-bed tertiary care teaching hospital in Chicago, IL, and was approved by the Institutional Review Board of Northwestern University. Patients are admitted to the Hospital Medicine Service from the Emergency Department or directly from physicians' offices based on bed availability in a quasi-randomized fashion. Hospitalists included in the study cared for patients without the assistance of housestaff physicians and worked 7 consecutive days while on service, usually followed by 7 consecutive days off service. During weeks on service, hospitalist shifts started at 7 AM and ended between 5 PM and 7 PM.

Data Collection Tool Development

To facilitate collection of detailed information sought for this study, we developed an electronic data collection tool. A systematic review of the medical literature on time studies performed by our research group indicated a lack of methodological standardization and dissimilar activity categorizations across studies.[12] We attempted to develop a standardized method and data collection instrument for future studies, and first created a data dictionary consisting of a list of hospitalist activities and their descriptions. The initial components were drawn from prior time-motion studies[9,13,14] and input from experienced hospitalists (KJO and MVW). The activity list was then refined after a preliminary observation period in which five hospitalists were followed for a total of 6 shifts. Observers noted the specific activities being performed by the hospitalists and asked for explanations and clarification when necessary. In order for an activity to be included in the final list, the activity had to be easily observable and identifiable without subjective interpretation from the observer. The preliminary observation period ended once we were satisfied that no new activities were emerging.

The compiled list of activities was then broken down into related groups and separated into additional subcategories to increase the specificity of data collection. The final list of activities was reviewed by several experienced hospitalists to ensure completeness. The data dictionary was then loaded onto a Palm Pilot Tx® using WorkStudy+ Plus® software. The final activity list consisted of 8 main categories, 32 secondary categories, and 53 tertiary categories (See Appendix). To facilitate comparisons with prior studies, we followed the convention of including the categories of "direct" and "indirect" patient care. We defined direct patient care as those activities involving face-to-face interaction between the hospitalist and the patient. The more general indirect care category encompassed other categories of activity relevant to the patient's care but not performed in the presence of the patient (ie, professional communication, interaction with the EMR, and other patient related activities like searching for medical knowledge on the Internet or reading telemetry monitors).

Pilot Testing

We trained 6 observers in the use of the data collection tool. Each observer practiced shadowing for more than 20 hours with the tool before collecting study data. During this pilot testing phase we optimized the layout of the tool to facilitate rapid documentation of hospitalist activities and multitasking. Interobserver reliability was confirmed by having 2 observers shadow the same hospitalist for a three hour time period. In all cases, the observers obtained an average interclass correlation coefficient of at least 0.95 with a 95% confidence interval of .85 to 1.0 prior to collecting study data.

Study Design

Data collection occurred between July and September of 2008. A total of 24 hospitalists were observed, each for 2 complete weekday shifts starting at 7 AM and ending between 5 PM and 7 PM. Of note, we only observed hospitalists who were directly caring for patients and not part of a teaching service. Each hospitalist was contacted about the project at least a week prior to any observations and informed consent was obtained. A single observer shadowed a single hospitalist continuously, trading off with a new observer every 3 hours to avoid fatigue. To minimize any "observation effect" our data collectors were instructed not to initiate and to minimize conversation with the hospitalists. At the end of the hospitalist's shift the following data were tallied: the number of patients in the hospitalist's care at the beginning of the day, the number of patients discharged during the day, and the number of admissions. Patient load

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TABLE 1. Mean Percentage of Time Spent on Main-Categories and Sub-Categories

Main Category	% Total Observed Activities	(95% CI)*	Subcategory	% Main Category	(95% CI)*
EMR*	34.1	(32.4–35.9)			
			Writing	58.4	(55.7–61.0)
			Orders	20.2	(18.5–21.9)
			Reading/reviewing	19.4	(17.3–21.5)
			Other	2.1	(1.8–2.5)
Communication*	25.9	(24.4–27.4)			
			Outgoing call	36.9	(33.6–40.2)
			Face to face	28.1	(25.2–31.0)
			Incoming call	14.4	(12.6–16.3)
			Sending page	8.6	(7.7–9.4)
			Rounds	3.8	(1.8–5.8)
			Receiving page	3.4	(2.9–4.0)
			E-mail	2.9	(1.8–3.9)
			Reviewing page	1.8	(1.3–2.3)
			Fax	0.1	(0.0–0.2)
Direct care	17.4	(15.9–18.9)			
Professional Development	6.5	(4.4–8.5)			
Travel	6.2	(5.6–6.7)			
Personal	5.7	(4.1–7.2)			
Other indirect care*	3.9	(3.4–4.4)			
Wait	0.4	(0.2–0.5)			

Abbreviations: CI, confidence interval; EMR, electronic medical records.
*Included in indirect care.

was determined by adding the number of admissions to the number of patients at the beginning of the day.

Data Analysis

Minutes were tallied for each of the categories and subcategories. Data is reported as percentages of total duration of observed activities (ie, including multitasking) unless otherwise specified. To explore the effect of patient volume on hospitalist workflow we performed *t*-tests comparing the number of minutes hospitalists spent per patient in various activities on days with below average patient volume as compared to those with above average volume. Additionally, we performed a Wilcoxon two-samples test to check for a difference in length of shift between these 2 groups.

Results

A total of 24 hospitalists were shadowed for a total of approximately 494 hours. For 43 of these hours a hospitalist was observed performing 2 tasks simultaneously, bringing the total duration of observed activities to 537 hours with multitasking. The hospitalists were a mean 34 ± 1.1 years of age and 12 (50%) were female. Twenty (83%) had completed residency 2 or more years prior to the study, 2 (8%) had a year of hospitalist experience since residency, and the remaining 2 (8%) had just completed residency. Sixteen (67%) hospitalists were Asian or Pacific Islanders, 6 (25%) were White, and 2 (8%) were Black. The hospitalists cared for an average of 13.2 ± 0.6 patients per shift and an average shift lasted 10 hours and 19 minutes ± 52 minutes.

Table 1 lists the mean percentage of time hospitalists spent on the various activities. Subjects spent the most time (34.1%) interacting with the EMR. Communication and direct care were the next most frequent activities at 25.9% and 17.4% of each shift respectively, followed by professional development (6.5%), travel (6.2%), personal time (5.6%), other indirect care (3.9%), and waiting (0.4%). The 3 subcategories included in indirect care time accounted for about 64% of all recorded activities.

Of the nearly 4 hours (233 minutes) per shift hospitalists spent using the EMR, the majority (58.4%) was spent documenting (See Table 1). Placing orders and reading/reviewing notes were nearly equal at 20.2% and 19.4% respectively, and other EMR activities took 2.1% of EMR time. Over half of the time (54.1%) hospitalists spent documenting in the EMR system was dedicated to progress notes. The remainder of effort was expended on writing histories and physicals (15.3%), discharge instructions (14.7%), discharge summaries (7.9%), sign-outs (6.8%), and performing medication reconciliation (1.4%). Of the time spent reading and reviewing documents on the EMR, most was spent reviewing lab results (45.4%) or notes from the current admission (40.4%). Reviewing imaging studies occupied 8.1%, and notes from past encounters accounted for 6.2% of this category's time.

Various modes of communication were used during the nearly three hours (176 minutes) per shift dedicated to communication. Phone calls took up approximately half of the hospitalists' communication time, with 36.8% spent on outgoing calls and 14.2% incoming calls. Face-to-face communication was the next most common mode, accounting for

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28.2% of the total. Time spent sending pages (8.8%), receiving pages (3.4%), and reviewing pages (1.8%) consumed 14% of all communication time. E-mail and fax were used sparingly, at 3.1% and 0.1% of communication time, respectively. Finally, meetings involving other hospital staff (interdisciplinary rounds) occupied 3.4% of communication time.

The amount of time hospitalists spent communicating with specific types of individuals is shown in Table 2. Hospitalists spent the most time communicating with other physicians (44.5%) and nurses (18.1%). They spent less time communicating with people from the remaining categories; utilization staff (5.7%), patients' family members (5.6%), case managers (4.2%), primary care physicians (3.4%), ancillary staff (3.1%), and pharmacists (0.6%). Communication with other individuals that did not fit in the above categories accounted for 8.8%, and 5.3% of communication could not be clearly categorized, generally because the hospitalist was communicating by phone or text page and ascertaining with whom would have required significant interruption.

We found that 16% of all recorded activities occurred when another activity was also ongoing. This means that hospitalists were performing more than one activity for approximately 54 minutes per day, or about 9% of the average 10.3-hour shift. Instances of multitasking occurred frequently, but were usually brief; the hospitalists performed 2 activities simultaneously an average of 75 times per day, but 79% of these occurrences lasted less than 1 minute. Of the 86 hours of multitasking activities recorded, 41% was communication time and another 41% was EMR use. This means that a second activity was being performed during 19% of the time hospitalists spent using the EMR and 26% of the time they spent communicating. Of the time spent on critical documentation activities like writing prescriptions and orders, 24% was recorded during a multitasking event.

The amount of time hospitalists spent per patient on days with above average patient volume as compared to those with below average patient volume is shown in Table 3. Hospitalists with above average patient numbers spent about 3 minutes less per patient interacting with the EMR (a 17% reduction; $P < 0.01$), and about 2 minutes less per patient communicating (a 14% reduction; $P < 0.01$). The average length of shift increased by 12 minutes on days when patient volume was above average; $P < 0.05$.

TABLE 2. Communication Time and Target

Subcategory	% Main Category	(95% CI)*
Inpatient physician	44.5	(41.7–47.2)
Nursing staff	18.0	(16.0–19.9)
Other	8.5	(6.8–10.2)
Family	5.8	(4.0–7.7)
Utilization staff	5.8	(4.6–7.0)
Uncategorized	5.7	(3.7–7.6)
PCC	4.0	(2.3–5.7)
PCP	3.6	(2.7–4.5)
Ancillary staff	2.9	(2.2–3.7)
Pharmacy	1.4	(0.8–2.0)

Abbreviations: CI, confidence interval; PCC, patient care coordinator; PCP, primary care physician.

Discussion

To our knowledge, this study represents the largest time-motion evaluation of hospitalist activities ever undertaken, and provides the most detailed assessment of hospitalists' activities when caring for patients without residents or medical students. We confirmed that hospitalists spend the majority of their time (64%) undertaking care activities away from the patient's bedside, and are involved in direct patient care contact only 17% of their time, averaging about 9 minutes per patient. The hospitalists spent about a quarter (26%) of their time communicating with others. Compared to other physicians, this is an unusually large amount of time. For example, Hollingsworth et al.[15] found that emergency medicine physicians spent just half as much (13%) of their time on communication with other providers and staff. This may reflect hospitalists' central role in the coordination

TABLE 3. Mean Minutes Per Patient for Above and Below Average Census Days

Subcategory	Minutes: Below Average Census	(95% CI)*	Minutes: Above Average Census	(95% CI)*	Pr > |t|
EMR	19.12	(17.50–20.75)	15.83	(14.17–17.49)	<.001
Communication	14.28	(12.86–15.71)	12.21	(11.07–13.36)	0.002
Direct care	9.30	(8.18–10.42)	8.59	(7.27–9.91)	0.293
Professional development	4.09	(2.36–5.81)	2.57	(1.26–3.89)	0.026
Personal	3.52	(2.39–4.65)	2.05	(1.29–2.82)	0.032
Travel	3.32	(2.86–3.79)	2.93	(2.64–3.22)	0.566
Other indirect care	2.37	(1.90–2.84)	1.65	(1.32–1.98)	0.292
Wait	0.25	(0.08–0.41)	0.14	(0.04–0.25)	0.881

Abbreviations: CI, confidence interval; EMR, electronic medical records.

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of consulting specialists. The other significant portion of hospitalists' effort focuses on documentation in the electronic medical record, with 22% of their time required for CPOE and note writing, and overall a third of their time (34.1%) committed to interacting with the EMR.

In many respects, our results confirm the findings of O'Leary et al.'s previous work. While this current study more precisely identified how hospitalists spend their time, the general proportions of times were similar. Both studies found that indirect care activities occupied about two-thirds of hospitalists' time (64% in this study and 69% in the previous study). We also documented similar portions of total time for direct patient care (17% vs. 18%) and communication (26% vs. 24%). Interestingly, with complete implementation of the EMR system, the percentage of time spent on documentation appeared to decrease. O'Leary et al. reported that documentation accounted for 26% of hospitalists' time, while the equivalent activities (writing in the EMR or paper prescriptions) accounted for only 21% in the current study. Unfortunately, the significance of this finding is difficult to determine given the concurrent changes in patient volumes and the varying extent of EMR implementation during the earlier study.

Over half of hospitalists' communication time is spent either making or receiving phone calls. This suggests that efforts to facilitate communication (eg, use of mobile phone systems and voicemail) might enhance efficiency. Additionally, we found that nearly half of our hospitalists' communication was with other physicians. Not surprisingly, our study confirmed that an important part of hospitalists' work involves organizing and collaborating with a variety of specialists to provide optimal care for their patients.

Hospitalists spent a great deal of time multitasking. We found that multitasking time accounted for nearly 1 of every 10 minutes during the day. The most common combination of activities involved communication that occurred during a period of EMR use. These interruptions could have serious consequences should physicians lose track of what they are doing while ordering procedures or prescribing medications.

We documented a smaller portion of multitasking time than O'Leary's earlier study. This could be due to differences in how multitasking was defined or recorded in the 2 studies. Our electronic data collection tool allowed us to capture rapid task switching and multitasking to the second, rather than to the minute, as was done with the stopwatch and paper form used in the previous study. This precision was important, especially considering that nearly 80% of the recorded instances of multitasking lasted less than 1 minute.

Our data also suggests that patient census has significant effects on certain parts of hospitalist workflow. Patient volume for our subjects ranged from 10 to 19 patients per shift, with a mean of 13.2 patients. The amount of time our hospitalists spent with each patient did not differ significantly between above and below average census days. However, EMR time per patient was significantly reduced on above average census days. Anecdotally, several of our hospitalists suggested that on high census days they put off less time-sensitive documentation activities like discharge summaries until after they leave the hospital and complete the work from home or on the following day. Thus, our study likely underestimates the total additional effort on high volume days, but unfortunately we had no direct way of quantifying work performed outside of the hospital or on subsequent days. Communication time was also significantly reduced when patient volumes were above average, suggesting that hospitalists had less time to confer with consultants or answer the questions of nurses and patient family members.

Several factors limit the interpretation and application of our findings. First, our study was conducted at a single urban, academic hospital, which may limit its applicability for hospitalists working at community hospitals. Given that more than 90% of hospital care in the U.S. occurs in the community hospital setting, research to confirm these findings in such hospitals is needed.[16] Nonclinical research assistants collected all of the data, so the results may be limited by the accuracy of their interpretations. However, our extensive training and documentation of their accuracy serves as a strength of the study. Finally, we focused exclusively on daytime, weekday activities of hospitalists. Notably, 3 hospitalists work through the night at our facility, and 24-hour coverage by hospitalists is increasingly common across the U.S. We expect weekend and night shift workflow to be somewhat different from standard day shifts due to the decreased availability of other medical providers for testing, consults, and procedures. Future research should focus on potential differences in activities on nights and weekends compared to weekdays.

This extensive, comprehensive analysis of hospitalist activities and workflow provides a foundation for future research and confirms much of O'Leary et al.'s original study. O'Leary's simpler approach of observing smaller blocks of time rather than full shifts proved effective; the two methodologies produced markedly similar results. The current study also offers some insight into matters of efficiency. We found that hospitalists with higher patient loads cut down on EMR and communication time. We also confirmed that hospitalists spend the largest portion of their time interacting with the EMR. A more efficient EMR system could therefore be especially helpful in providing more time for direct patient care and the communication necessary to coordinate care. Given that most hospitals provide financial support for hospital medicine programs (an average of $95,000 per hospitalist full-time equivalent (FTE)[1]), hospital administrators have a keen interest in understanding how hospitalists might be more efficient. For example, if hospitalists could evaluate and manage two additional patients each day by exchanging time focused on medical record documentation for direct care activities, the "cost" of a hospitalist drops substantively. By understanding current

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hospitalist activities, efforts at redesigning their workflow can be more successful at addressing issues related to scheduling, communication, and compensation, thus improving the overall model of practice as well as the quality of patient care.[17]

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