Journal of HOSPITAL MEDICINE www.journalofhospitalmedicine.com

ORIGINAL RESEARCH

Hospitalist Time Usage and Cyclicality: Opportunities to Improve Efficiency

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Disclosure: Nothing to report.

BACKGROUND: Academic medical centers (AMCs) have a constrained resident work force. Many AMCs have increased the use of nonresident service hospitalists to manage continued growth in clinical volume. To optimize their time in the hospital, it is important to understand hospitalists' work flow.
DESIGN: We performed a time-motion study of hospitalists carrying the admission pager throughout the 3 types of shifts we have at our hospital (day shift, swing shift, and night shift).
SETTING: Tertiary academic medical center in the Midwest.
RESULTS: Hospitalists spend about 15% of their time on direct patient care, and two-thirds of their time on indirect patient care. Of the indirect activities, communication and documentation dominate. Travel demands make up over 7% of a hospitalists' time. There are spikes in indirect patient care, followed closely by spikes in direct patient care, at shift changes.
CONCLUSIONS: At our AMC, indirect patient care activities accounted for the majority of the admitting hospitalists' time spent in the hospital, with documentation and communication dominating this time. Travel takes a significant fraction of hospitalists' time. There is also a cyclical nature to activities performed throughout the day, which can cause patient delays and impose variability on support services. There is a need for both service-specific and systemic improvements for AMCs to efficiently manage further growth in their inpatient volume. ***Journal of Hospital Medicine*** **2010;5:329–334**. © 2010 Society of Hospital Medicine.

KEYWORDS: efficiency, hospitalist, lean thinking, time study.

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Many academic medical centers (AMCs) employ hospitalists to provide care for patients on resident services as supervising attendings,[1,2] as well as on nonresident services.[3] The number of hospitalists working on nonresident services at AMCs has grown exponentially, as the Accreditation Council for Graduate Medical Education (ACGME) implemented duty-hour standards for residents.[3] According to the latest Society of Hospital Medicine (SHM) estimates, the number of practicing hospitalists is projected to grow to 30,000 by 2010.[4] As astonishing as this growth may sound, it is anticipated that more hospitalists will be needed to meet the demand for these physicians.[5] Further, as financial realities require AMCs to be increasingly efficient without compromising patient care, and hospitalists provide a greater range of clinical services, it is important to better understand how hospitalists spend their time in the hospital. Understanding the daily work flow of hospitalists can identify how these physicians can be better supported. A previous report by O'Leary et al.[6] highlighted how hospitalists spent their time during their usual day shifts at an AMC. It is important to validate their study to determine broadly applicable findings. We performed a time-motion study where we followed the admitting hospitalists during the day and night shifts. We felt it was important to focus on hospitalists who are admitting patients, as this has potential patient safety and quality implications related to multitasking, triaging, and helping patients navigate through a complex admission process involving multiple clinical services. Our goal was to better understand how the flow of patients impacted these physicians, and determine how our hospitalists spent their time providing direct and indirect patient care-related activities. In addition, we looked for predictable variations in activities throughout the day that might be associated with the timely care of patients.

Materials and Methods

Setting

The University of Michigan Health System (UMHS) is a tertiary care AMC, with more than 800 beds, and over 34,000 annual adult discharges. Internal Medicine services comprise a large proportion of those discharged, accounting for over 17,000 discharges per year; and is projected to grow at an annual rate of 4%. As service caps and work-hour restrictions have limited the total number of patients that medical residents are able to care for, our hospitalist group has increased the number of physicians on the nonresident hospitalist service. At the time of the study, there were 23 hospitalists, equivalent to 18.25 full-time equivalents (FTEs),

2010 Society of Hospital Medicine DOI 10.1002/jhm.613
Published online in Wiley InterScience (www.interscience.wiley.com).

TABLE 1. Coding of Physician Activities by Direct vs. Indirect Care in Time-Motion Analysis

Category	Code	Description
Direct patient care	DPIH	Initial history
	DPDI	Discharge instructions
	DPFM	Family meetings
	DPRV	Revisit
	DPCC	Cross-cover
Indirect patient care		
Documentation	IDGD	General documentation
	IDDN	Daily notes
	IDDD	Discharge navigator
Records/Results	IPMR	Review medical records
Communication	ICHH	Patient handoffs
	ICFF	Face-to-face
	ICIP	Incoming page
	ICOP	Outgoing page
	ICIC	Incoming call
	ICOC	Outgoing call
	ICEE	E-mail communications
	ICDP	Discharge planner
Orders	IOWO	Writing orders
Professional development	PDRR	Reading articles, textbooks, references
Education	EEWR	Teaching during work rounds
Travel	TTTT	Travel
Personal	PPPP	Personal
Down time	DDDD	Downtime

staffing the service. The hospitalists provide in-house patient care 24 hours a day and 7 days a week. Hospitalists also provide general medicine consult services, surgical comanagement and perioperative care, procedures, inpatient cardiopulmonary arrest response, rapid response team supervision, and observation care; and are also the primary inpatient physicians for many of the hospitalized interventional radiology and dermatology patients. These direct patient care activities account for 4500 annual discharges from the nonresident service.

Data Collection

Four university undergraduate business administration program students shadowed 11 hospitalists over a 3-week period in 4-hour to 12-hour time blocks. The students followed the hospitalist on the shift that was taking admission calls, during day and night. A data collection tool was designed to track physicians' actions in 1-minute increments, using categories similar to those used in a previously published time-motion study of hospitalists' activities (Table 1).[6] Physicians' activities each minute were assigned to a single category that most represented their action during that time period. At our AMC, 6 hospitalists work during the day shifts, and 2 on the night shifts. Our hospitalists may have patients in any of the 14 general care units in the hospital, as our hospitalists' services are not geographically based. The day hospitalists' shifts are scheduled from 7 AM to 7 PM. Two of the 6 hospitalists rotate through a 3-day cycle as the admitting physician. Their duties include triaging and admitting patients until 2 PM, providing the day-to-day care for their patients until 7 PM, and occasionally cross-covering for the other day-shift hospitalists that have left for the day. The 4 other day-shift hospitalists, not on their rotation as the admitting physician, may sign out and leave as early as 4 PM if their work for the day is done. At 2 PM, a separate "swing-shift" hospitalist takes over the role of triaging and admitting until 7 PM. During the day shift, consults and perioperative management of patients are provided by a separate hospitalist on the "consult service." At 7 PM, 2 nocturnists arrive for their 7 PM to 7 AM shift. The nocturnists, in addition to cross-covering service patients, admit a maximum of 6 patients each, or until midnight—whichever comes first.

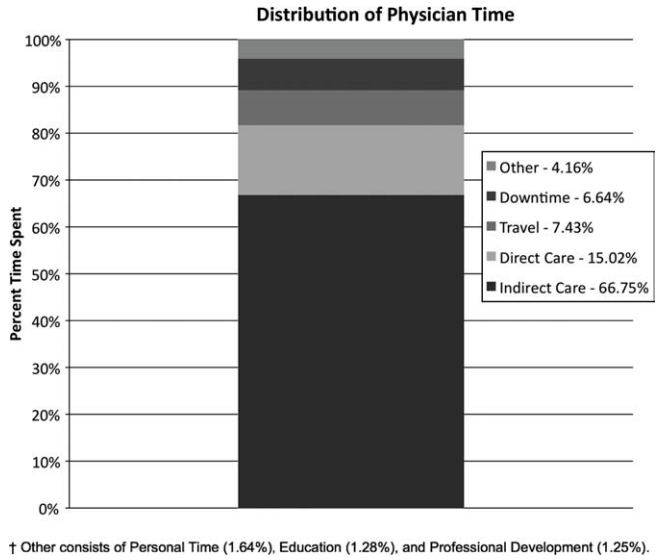

FIGURE 1. Bar graph showing the distribution of hospitalists' time spent on indirect patient care, direct patient care, and various types of other non-patient-care activities.

The students observed 11 different hospitalists, and followed these physicians during 9 weekday shifts, 5 weekday swing shifts, 10 weekday night shifts, and 4 weekend night shifts. The variance in the number of each type of shifts monitored was likely due to scheduling limitations of the students. In total, they collected data on 8,915 minutes of hospitalists' activities. The students monitored the hospitalists representing time periods from 7 AM to 2 AM. Analysis from 2 AM to 7 AM was excluded, because after 2 AM the hospitalists did not routinely evaluate new patients with the exception of emergent requests. New admissions after midnight are handled by a night float service staffed by residents.

Results

Overall, time spent on patient care activities comprised the bulk of hospitalists' shifts (82%) (Figure 1). Patient care activities were further categorized as direct patient care—defined as face-to-face patient or family time; and indirect patient care—defined as activities related to patient care, but without patient or family contact. Direct and indirect

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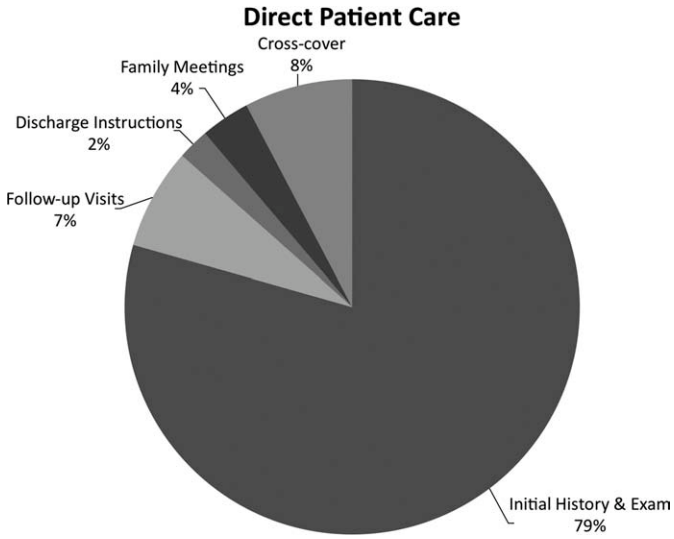

FIGURE 2. Distribution by types of direct patient care activities: history and initial evaluation, follow-up or repeat visit on the same day, cross-cover activities, attending family meetings, and providing discharge instructions.

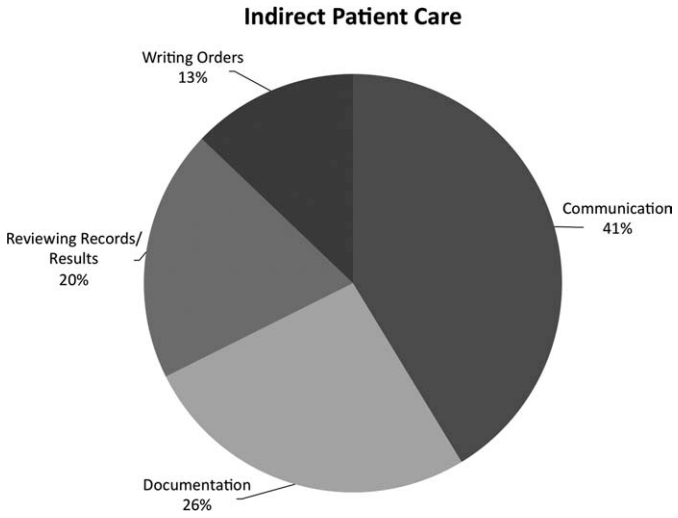

FIGURE 3. Distribution by types of indirect patient care activities: communication, documentation, reviewing records and results, and writing orders.

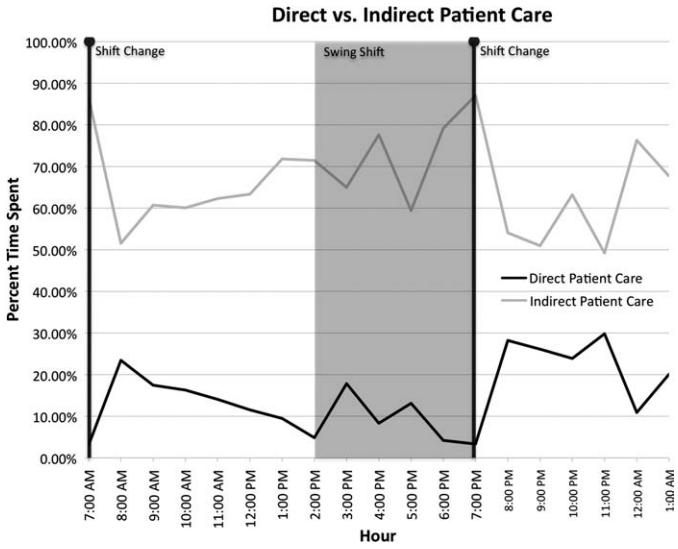

FIGURE 4. Hourly distribution of time spent on direct and indirect patient care by a hospitalist, revealing the cyclicality of daily activities by hospitalists (see Results).

patient care accounted for 15% and 67% of the hospitalists' time, respectively. The other 18% of the hospitalists' time spent in the hospital were broadly categorized into: professional development, education, personal, downtime, and travel. Professional development included activities such as looking up information (eg, literature search); education included times that hospitalists spent with residents or medical students; personal time included only restroom and food breaks; and travel included time spent moving from 1 area to the next during their shift.

The majority of the hospitalists' direct patient care time was spent on evaluating new patients (79%). Significantly smaller amounts of time were spent on other direct care activities: cross-covering other patients (8%), follow-up visits (7%), family meetings (4%), and discharge instructions (2%) (Figure 2).

Indirect patient care activities included, 41% of time used to communicate with other healthcare providers, 26% on medical documentation, 20% reviewing medical records and results, and 13% of time writing orders (Figure 3). Communication accounted for a large proportion of a hospitalists' work, and included telephone conversations with Emergency Department (ED) or other admitting providers, handoffs, paging, face-to-face conversations with consultants and other support staff, and e-mail.

Figure 4 shows the hourly distribution of time spent on direct and indirect patient care by a hospitalist throughout the day. The day-time hospitalists pick up their signout from the nocturnists at 7 AM to begin their shift. The swing hospitalists arrive at 2 PM during the weekdays, and their primary duty is to triage and admit patients until 7 PM. The nocturnists start their shift at 7 PM, at which time the day-time and swing-shift hospitalists all sign out for the night.

Discussion

Hospitalists on the nonresident service at our AMC utilize about 15% of their time on face-to-face patient care activities, 67% on indirect patient care activities, and 7% of time on moving from 1 part of the hospital to another. Hospitalists are valuable members of the physician work force who address the increasing patient care demands in the face of increasing limitations on residency work-hours, a growing aging population, and existing inefficiencies in AMCs. The only other work-flow study of hospitalists of which we are aware provided a single institution's perspective on time utilization by hospitalists. Our study in a different AMC setting revealed strong consistency with the O'Leary et al.[6] study in

2010 Society of Hospital Medicine DOI 10.1002/jhm.613
Published online in wiley InterScience (www.interscience.wiley.com).

the fraction of time hospitalists spent on direct patient care (15% and 18%, respectively), indirect patient care (67% and 69%); and within indirect patient care the time spent on documentation (26% and 37% of total time) and communications (41% and 35%). While travel in the O'Leary et al.[6] study took up only 3% of hospitalists' time, the conclusions in that paper clearly suggest that the authors consider it an area of concern. Our study found that travel accounted for over 7% of hospitalists' time, confirming that intuition. The significant travel time may in part reflect the effects of a non-geographically-located hospitalist service. From these 2 studies we can be more confident that in large, tertiary care AMCs the time hospitalists spend on indirect patient care dominates that for direct patient care (by a factor of 4 in these studies), that within indirect patient care documentation and communication are dominant activities, and that travel can take a significant amount of time when patients are dispersed throughout the facility.

Both studies demonstrated that communication accounted for a significant proportion of a hospitalist's time. In our study communication accounted for 28% of their total time in the hospital, and 41% of the indirect patient care portion (Figure 3). A closer look within our communication category revealed that phone calls and handoffs accounted for two-thirds of all communication time observed. As the hospitalists who carry the admitting pager, they receive the pages to take admission calls, but also take calls from consultants who have recommendations, as well as from nursing and other hospital staff. Depending on the nature of the conversation, the phone calls can last several minutes. While ensuring the communication between health care providers is complete and thorough, there may be opportunities to develop novel approaches to the way hospitalists communicate with other care providers. For example, at the UMHS, alternative communication methods with nursing staff have been proposed such as utilizing a website or a handheld device to help hospitalists prioritize their communications back to the nursing staff[7]; while standardizing the intake information from the ED or other admitting providers may help reduce the total time spent on phone calls. We will need to further explore the potential benefits of these ideas in future work.

Our data also reveal an interesting cyclicality of daily activities for the hospitalists, as shown in Figure 4. We identified batching behaviors throughout the day, which cause delays in seeing patients and can be deleterious to smooth workflows in support services. Spikes in indirect patient care, followed closely by spikes in direct patient care, occur regularly at shift changes (7 AM, 2 PM, and 7 PM). Also, in the night shift, indirect patient care drops to its lowest levels (in % of time spent) throughout the day, and direct patient care reaches its highest levels. The day-shift indirect care profile is counter-cyclical with direct care, as the hospitalist shifts between direct care and indirect care depending on the time of the day. We discuss these phenomena in turn.

It is known that variability in any operation causes congestion and delay, as an unavoidable consequence of the physics of material and information flows.[8] Indeed, an entire subindustry based on Lean manufacturing principles has evolved from the Toyota Production System based on the elimination of unnecessary variability in operations.[9] Lean processes have been ongoing in manufacturing facilities for decades, and these efforts are just recently being embraced by the service sector in general, and health care specifically.[10,11] Batching is an extreme form of variability, where there is a lull in the amount of work being done and then a burst of work is done over a short period of time. This means that jobs pile up in the queue waiting for the next spike of activity. Our data indicate batching seems to be a common phenomenon for our hospitalists. The majority of the patients admitted to our hospitalist service are unscheduled admissions that arrive primarily through the ED. One potential result of the unscheduled admissions is that patients could be referred to our hospitalist service at a pace that is not well predictable on an hour-to-hour basis. This could lead to an unintended result of multiple patients admitted over a short period of time. This means that many patients wait for intake, delaying the onset of their care by the inpatient physician. Also, since an initial exam often results in orders for laboratory tests and studies, batching on the floor will translate into batching of orders going to nursing, pathology, radiology, and other hospital support services. This imposes the cost of variability on these other services in the hospital. From a systems perspective, efficiency will improve if these activities can be smoothed throughout the day. This may suggest opportunities to work with the ED, to help smooth the inflow of patients into the hospital system.

Within the hospital, all of the day-shift hospitalists can be reached about the needs of their respective patients, however, the physician carrying the admission pager also fields calls for admissions, and acts as the default contact person for the hospitalist group. As this hospitalist receives information on new admissions, he/she is aware of patients ready for intake but cannot evaluate them at the rate they are being referred, so the queue builds. This continues into the swing shift, which also fields referrals faster than they can attend to them. The volatility in indirect care during the swing shift, 2 PM to 7 PM, reflects a significant amount of triaging and fielding general calls about hospitalist patients. These activities further reduce the swing shift's ability to clear the intake queue. The night shift finally gets to these patients and, eventually, clears the queue. There may be an opportunity to consider the use of multiple input pagers or other process changes that can smooth this flow and rationalize the recurring tasks of finding patients and the responsible physician.

Another concept in Lean thinking is that variability is costly when it represents a mismatch between demand for a service and the capacity to serve. With regards to admitted patients, when demand outpaces capacity, patients will

2010 Society of Hospital Medicine DOI 10.1002/jhm.613
Published online in Wiley InterScience (www.interscience.wiley.com).

wait. When capacity outpaces demand, there is excess capacity in the system. The ideal is to match demand and capacity at all times, so nobody waits and the system carries no costly excess capacity. As the intake providers for admitted patients, we can attack this problem from the capacity side. Here, 2 generic Lean tactics are to: (1) reallocate resources to a bottleneck that is holding up the entire system, and (2) relieve workers of time-consuming but non-value-adding work so they have more capacity to devote to serving demand. In our study, carrying multiple input pagers is an example of tactic (1), and efficient communication technologies and practices that reduce indirect time is an example of (2). Systemwide improvements would require further investigation by working with the variability on the input side (eg, ED admissions).

Our study also found that a significant percent of the time observed was spent traveling (7.4%) from room to room between different floors in the hospital. Travel time, which is non-value-adding, is one of the major forms of waste Lean thinking.[12] Our hospitalists can provide care to patients at any of the general medical-surgical beds we have available at our health system. These beds are distributed across 14 units on 5 different floors, as well as in the ED if a bed is not available for an admitted patient. In hospitals routinely operating at high occupancy, such as our AMC, patients often get distributed throughout the facility for lack of beds on the appropriate service's ward. One cost for this is a potential mismatch between a patient's needs and floor nurses' training. Our study reveals another cost, and that is its contribution to the significant amount of time hospitalists spent on travel, which is largely driven by the need to see dispersed patients. Reducing this cost requires a systemic, rather than service-specific, solution. Our AMC is adding observation-status beds to relieve some of the pressure on licensed beds, and considering bed management (including parts of the admissions and discharge processes) changes designed to promote better collocation of patients with services. Further study on these and other collocation tactics is warranted.

The spike in indirect activities at 4 PM represents, in part, an early signout by 1 or more of the hospitalists who are not scheduled to hold the admission pager, and have completed their work for the day. This handoff will be replicated at 7 PM when the nocturnists arrive for their night shift. In addition to a significant indirect load on physicians, multiple handoffs have been associated with decreased quality of care.[13] Again, it is worthwhile considering the feasibility of alternative shift schedules that can minimize handoffs.

Finally, our findings revealed that a low percentage of time was dedicated to providing discharge instructions (2.24% of direct patient care time, and 0.34% of total time). Because the task of discharging patients falls primarily on the day-shift hospitalists, when combined with swing-shift and night-shift hospitalists' data, the low percentage measured on discharge instructions may have been diluted. Nonetheless, this may point to the need for further investigation on how hospitalists provide direct patient encounter time during this critical phase of transition out of the hospital.

Our study is not without limitations. The student observers shadowed a representative group of hospitalists, but they were not able to follow everyone in the group. More specifically, their observations were made on the hospitalist who was carrying the primary "hospitalist service" admitting pager. Although it was the intent of our study to focus on the hospitalists we felt would be the busiest, our results may not be generalizable to all hospitalists. Although our research supports the previous findings by O'Leary et al.,[6] a second limitation to our study is that our analysis was done at a single hospitalist group in an AMC, and hence the results may not be generalizable to other hospitalist groups. Another limitation may be that we did not do an evaluation of the hours between 2 AM to 7 AM. This period of time is used to catch up on medical documentation and to be available for medical emergencies. As more hospitalist programs are employing the use of nocturnists, it may be informative to have this time period tracked for activities.

Conclusions

Our study supports the broad allocation of hospitalist time found in an earlier study at a different AMC,[6] suggesting that these might be generally representative in other AMCs. We found that travel constitutes a significant claim in hospitalists' time, due in part to the inability to collocate hospitalist service patients. Remedies are not likely to be service-specific, but will require systemwide analyses of admission and discharge processes. Communication takes a significant amount of hospitalist time, with pages and phone calls related to handoffs accounting for most of the total communication time. As hospitalists working at non-AMC settings may experience different work flow issues, we would like to see time-motion studies of hospitalists in other types of hospitals. Future studies should also seek to better understand the how hospitals at high occupancy may reduce batching and streamline both the discharge and admission process, determine the factors that account for the significant communication time and how these processes could be streamlined, and evaluate the potential benefits of geographical localization of hospitalists' patients.

Acknowledgements

The authors thank Tracey Jackson, Michael Paulsen, Deepak Srinivasin, and Ryan Werblow, who were students in the undergraduate business school program, for their invaluable contribution in shadowing hospitalists to collect the time study data.

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2010 Society of Hospital Medicine DOI 10.1002/jhm.613
Published online in wiley InterScience (www.interscience.wiley.com).

8401; E-mail: seoungk@umich.edu Received 26 March 2009; revision received 19 August 2009; accepted 23 August 2009.

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2010 Society of Hospital Medicine DOI 10.1002/jhm.613
Published online in Wiley InterScience (www.interscience.wiley.com).