ORIGINAL RESEARCH

A Time-Motion Study of Emergency and Hospitalist Physicians in a Community Hospital Setting

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ABSTRACT

Introduction: Research has shown that low physician work satisfaction correlates with burnout. Having sufficient time at the patient's bedside is one element that contributes to work satisfaction. Interruptions, on the other hand, have been implicated as a potential cause of both worker dissatisfaction and clinical error. Better understanding how direct patient care and interruptions affect physician satisfaction may aid in developing future interventions to reduce burnout and improve patient safety.

Methods: We conducted an observational, time-motion study to assess how physicians spend their time and correlated these findings to physician satisfaction. This study was conducted in July 2020 (7/1/20 - 7/15/20) at a 591-bed community hospital. A total of 114 emergency medicine (EM) physicians and hospitalists were eligible for participation. Participants were recruited by email. Two trained medical students categorized and recorded the activities of 13 EM and 8 hospitalist physicians and documented the number of interruptions they experienced. An anonymous survey was also employed to investigate participants' perceptions about interruptions and how they spend their time. We compared the responses from the subjective survey to the objective data to identify activities that may positively or negatively impact participant satisfaction.

Results: 18.4% of all eligible physicians participated in the study. In summary, our study showed that EM and hospitalist physicians dedicate roughly double the amount of time to indirect patient care (56.3%) compared to direct patient care (25.8%). EM physicians had more than twice the number of interruptions as hospitalists (every 4.4 minutes vs. every 11.3 minutes). From our survey results, we found no statistically significant difference between the perceived and observed proportion of time spent on direct and indirect patient care for EM physicians ($p = 0.62$ direct; 0.21 indirect) or hospitalists ($p = 0.82$ direct; 0.69 indirect). However, there was a statistically significant difference between perceived (overestimated) and observed number of interruptions reported by EM physicians ($p = 0.02$).

Conclusion: The observational data along with the survey results indicate a desire to reduce indirect patient care and increase time at the bedside — suggesting that interventions that target this discrepancy may increase physician work satisfaction and therefore decrease burnout. Additionally, we found that EM physicians far overestimate the actual number of interruptions they experience —however, EM does still engender more than double the interruptions as hospitalists encounter, despite experiencing similar percentages of direct and indirect patient care.

INTRODUCTION

In the last decade, there has been an increased awareness of physician burnout. Burnout plays a major role in physician retention, not only in specific job positions, but in the career of medicine as a whole [1]. As more physicians continue to report experiencing burnout in their careers, amidst increasing impositions made by administrative tasks, the electronic medical record, and navigating barriers to care, it is imperative that we pursue a more comprehensive understanding of the factors that contribute to or prevent the development of physician burnout [2, 3].

Studies have shown that allocating greater time to patient interaction has a positive correlation to physician work satisfaction [4]. Currently, physicians tend to spend more time on indirect rather than direct patient care, as patient-related work now primarily occurs outside the patient room [5]. Moreover, there remains a need for data describing the workflow and task allocation for emergency medicine (EM) physicians and hospitalists. These providers are two of the top five largest medical specialties in the United States, [6] and burnout amongst EM providers has reached alarmingly high levels since the start of the COVID-19 pandemic [7, 8].

The effect of interruptions in the workplace on physician satisfaction and burnout is of growing interest. Interruptions by pagers, medical staff, and overhead announcements can result in significant disruptions to a physician's workflow

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and concentration. Several studies have tied interruptions to an increase in clinical error [9, 10]. However, there is limited research investigating the effects of interruptions on physician job satisfaction. A 2019 study found a discrepancy between perceived versus actual number of disturbances and interruptions experienced by EM physicians [11]. Although no direct link to interruptions and burnout was established, authors raised an important issue of the potential for inaccurate perception contributing to burnout.

METHODS

We conducted an observational time-motion study. Our objective was to quantify the amount of time physicians devote to indirect patient care, mainly the electronic health record (EHR), in comparison with patient bedside care, and then correlate provider satisfaction with their perception of time spent in the workday. In addition, we assessed the average number of interruptions experienced by EM physicians and hospitalists over time.

Our observations took place in July 2020 (7/1/20 - 7/15/20)-at a 591-bed community hospital. The emergency department (ED) receives more than 90,000 annual visits leading to 26,000 annual admissions, making it one of the highest volume hospitals in the state. At the time of the study, the hospital utilized a computerized EHR as well as electronic ordering and lab/radiology results. Both EM and hospitalist department computers included integrated Dragon speech recognition software.

Study Design

Two trained medical students observed the activities of EM and hospitalist physicians for a total of 80 hours. Observations took place in two-hour windows punctuated with 20-minute breaks. We determined that two-hour windows would mitigate observer fatigue and thus maintain reliability. Each observer completed a maximum of three observation windows per day, following providers at different points throughout their shifts to ensure an accurate portrayal of daily workflow (**Table 1**). The observed physicians worked as community attending physicians without the presence of residents.

Table 1: Study Design and Observation Duration

Specialty	Shift Time	No. of Observation Windows	Total Time (hh:mm:ss)
Emergency Medicine	M-F Day	12	18:02:30
	M-F Night	5	10:01:15
	Sat-Sun Day	3	12:00:45
	Sat-Sun Night	0	00:00:00
	Total	**20**	**40:04:30**
Hospitalist	M-F Day	12	18:03:38
	M-F Night	5	10:01:22
	Sat-Sun Day	3	12:01:22
	Sat-Sun Night	0	00:00:00
	Total	**20**	**40:06:22**
	Cumulative	**40**	**80:10:52**

*A total of 21 physicians were observed (13 EM, 8 Hospitalist)

Observers followed participants at a distance of five feet to minimize the Hawthorne effect. They did not enter patient rooms. While other time-motion studies have had observers follow participants into patient rooms, the shortage of personal protective equipment (PPE) due to the COVID-19 pandemic combined with concerns about the Hawthorne effect guided the decision to omit observers from rooms.

Participants

All EM (44) and hospitalist (70) physicians were informed of and invited to participate in the study via email. Directors from both departments informed the providers that their involvement was entirely optional. Providers who did not wish to be a part of the study were instructed to decline to participate if approached by observers.

Participants were randomly selected and approached on the predetermined observation days. We purposely chose to exclude providers who used medical scribes to assist in documentation as we thought it would skew our results.

Participants were blinded to the intent of the study but were informed that it was observational, all data collected would be anonymized, and no patient information would be collected. They were instructed to ignore the presence of the observer (which included speaking to, teaching, and interacting with the observer) and to keep doors slightly ajar while in the patient room if the situation allowed.

Categorization Scheme

The categorization of physicians' activities was developed by the research team (**Table 2**) using similar time-motion studies as references [12-14]. Our major categories included direct patient care, indirect patient care, administrative activities, travel, personal activities, waiting, and other. Direct and indirect patient care were further categorized into sub-tasks of bedside patient care, procedures, chart review, ordering, documentation, staff communication, discharge, research, and PPE (Table 2). We categorized any time spent in patient rooms as "direct patient care" and specified "procedures" as a sub-task for EM physicians. We were interested in identifying the amount of time spent on patient EHR documentation and electronic ordering provide information for future quality improvement interventions. We tested our categorization scheme during a one-week pilot phase that preceded the official start of the study. This period was also utilized to develop a codebook to improve inter-rater agreement amongst observers when providers engaged in simultaneous tasks.

Interruptions

Interruptions experienced by participants were recorded by observers. We defined an interruption as any event that caused a disruption in the participant's current activity. We identified seven types of interruptions: ambulance arrival, code, internal interruption (sudden recall with no external stimulus), patient/patient family, pager/phone, staff, and workplace (noise).

Table 2: Categorization of Hospital Physician's Tasks

Category	Definition
Direct Patient Care	
Bedside care	Time spent in patient room directly engaging with patient or their family
Procedures	Time spent in patient room preparing for or engaging in a medical procedure
Indirect Patient Care	
Chart review	Viewing patient history, past and present lab/imaging results
Ordering	Electronic ordering of patient labs, imaging, medication; medication reconciliation on arrival
Documentation	Writing/dictating note in patient chart, charge capture (billing), L&I forms
Staff Communication	In-person or telephone communication with staff as it relates to patient care
Discharge	Writing/dictating discharge note, medication reconciliation on discharge
Research	Researching patient care-related topics on web browser or resource library (e.g. UpToDate)
PPE	Handwashing, gowning/degowning, taking on/off masks, sanitizing face shields
Administrative Activities	Professional tasks not related to patient care (i.e. attending meetings, checking professional email, looking at scheduling and staff list)
Personal Activities	Conversation with staff unrelated to work, eating, taking breaks, personal cell phone use
Travel	Walking, waiting for elevator, taking elevator
Waiting	Waiting to enter patient room, to begin meeting, for computer login, for phone answering service
Other	Miscellaneous tasks (i.e. logging into translation services computer, fixing printer)

Observer Training & Inter-Rater Reliability

Two medical students were trained as observers during a one-week period prior to the start of the study. Training included familiarization with the data collection applications and categorization scheme. Several mock observation windows were conducted and discrepancies between the independent observers' definitions of the categorization scheme were discussed and resolved.

Following training, we tested the reliability of our observation instruments by calculating inter-rater agreement between our two observers through the kappa coefficient. Reliability testing was conducted at the start of the study and halfway through the study. Both observers observed the same physician for three consecutive 4-minute periods. A timer occurred at 20-minute intervals and each observer independently categorized the activity observed at the sound of the timer. An average kappa coefficient was calculated from these three tests.

Data Collection and Statistical Analyses

Time-motion data for physician activities was collected by observers on a tablet using the Timery application [15]. Interruptions were simultaneously counted through a basic counter application [16]. The total duration for each categorized activity and number of interruptions was recorded into a spreadsheet at the end of each two-hour observation window. All identifying information about participants was anonymously coded, securely stored, and kept confidential.

Post-Observation Participant Survey

Following the observational data collection, all participants were asked to complete an anonymous electronic survey. The survey was not tested for validity. Participants were asked to estimate the percentage of time they spent on each activity. From their responses, we conducted a T-test to compare the differences between the perceived and observed percentage of time spent on direct and indirect patient care. The survey also included a questionnaire that sought to quantify participants' satisfaction with the amount of time they spent on each activity. A five-point Likert scale was employed to measure satisfaction.

IRB Statement

This study was considered a quality improvement project by an institutional review board and therefore was given an exemption. No patient information was collected. All participants provided verbal consent prior to observation. Only one physician declined to be a part of the study when approached by observers.

RESULTS

The final study cohort included 21 physicians: 13 EM and 8 hospitalist physicians. We conducted 40 two-hour observation windows for a total of approximately 80 hours of observation. Interruptions were simultaneously documented. **Table 3** shows the results of our time-motion observations and **Table 4** shows the number and types of interruptions documented.

We performed our inter-rater reliability test prior to the start of the study (0.93) as well as halfway through the study (0.89) to identify possible drift between observers with time. Both kappa coefficients were above 0.85 which indicated high inter-rater reliability with a small amount of drift [17].

Table 3: Percentage of Time Spent on Tasks for EM and Hospitalist Physicians*

Category	EM Physicians	Hospitalist Physicians	Both
Direct Patient Care	**30.8**	**20.8**	**25.8**
Bedside care	27.3	20.8	24.0
Procedures	3.6	0.0	1.8
Indirect Patient Care	**54.3**	**58.3**	**56.3**
Documentation	15.8	22.5	19.2
Chart Review	14.9	15.3	15.1
Staff Communication	13.4	10.3	11.9
Ordering	5.4	6.1	5.7
Discharge	3.7	1.9	2.8
PPE	0.7	1.5	1.1
Research	0.4	0.6	0.5
Administrative	0.6	1.4	1.0
Personal	5.7	9.8	7.8
Travel	6.4	8.1	7.3
Waiting	1.1	1.4	1.3
Other	0.9	0.3	0.6

*Percent time calculated from total time observed for each specialty

Table 4: Total Number of Interruptions for EM and Hospitalist Physicians Over 40 Hours of Observation

Name of category	EM Physicians	Hospitalist Physicians
Ambulance Arrival	9	0
Code	7	4
Internal	24	5
Pager	0	35
Patient/Patient Family	8	4
Phone	90	33
Staff	285	85
Workplace	121	72

Direct vs. Indirect Patient Care

From our observations, we found that together, EM and hospitalist physicians spend most of their time on indirect patient care (56.3%) and less than half as much time on direct patient care (25.8%).

Hospitalists spend more time on indirect patient care (58.3%) compared to EM physicians (54.3%). This difference is largely due to the greater amount of time that hospitalists spend on documentation (22.5%) compared to EM physicians (15.8%).

Interruptions

In this study, EM physicians experienced an interruption every 4.4 minutes, or an average of 2.1 interruptions in a ten-minute period. Hospitalists, on the other hand, experienced an interruption every 11.3 minutes, or an average of 0.85 interruptions in a ten-minute period.

Survey

As part of the survey, participants were asked to estimate the percentage of time they spent on direct versus indirect care, as well as their perceived number of interruptions. EM physicians estimated they spent 28.2% (+/- 18.0%) of the workday on direct patient care and 58.7% (+/- 15.3%) on indirect patient care. There were no statistically significant differences compared to observed values ($p = 0.62$ direct; 0.20 indirect). The estimated number of interruptions in a ten-minute period (mean = 12.2 +/- 13.0) was significant compared to observed number of interruptions (2.1 interruptions / ten-minute period; $p = 0.02$).

Hospitalists estimated they spent 21.3% (+/- 4.8%) of the workday on direct patient care and 53.8% (+/- 19.3%) on indirect patient care. The estimated number of interruptions in a ten-minute period was 2.3 (+/- 1.5). There were also no statistically significant differences compared to observed values ($p = 0.82$ direct; 0.68 indirect; 0.16 interruptions).

Respondents were also asked to share their preferences for how they would like to spend their time as a proxy to determine physician satisfaction (**Table 5**). All (100%) respondents expressed that they would prefer to spend "less" or "much less" time documenting in the EHR; 82% stated the same regarding time spent placing orders electronically. Conversely, 59% would rather spend "more" or "much more" time with patients while no (0%) participants thought that they would like to spend less.

DISCUSSION

Our results illustrate that physicians spend considerably more time performing indirect patient care than they do in direct contact with patients or patients' families. EM physicians at our facility spend 30.8% of their time at work in direct contact with patients compared to 54.3% of their time doing indirect patient care. Hospitalists spend even less time working directly with patients (22.3%) and slightly more time (56.7%) than EM physicians on indirect patient care.

These findings corroborate existing studies which also report significantly less time spent on direct patient care versus indirect patient care. In a community hospital setting, hospitalists spent 18% of their time working directly with patients [18]. Similarly, multiple studies on EM physicians have reported between 25-40% of time spent on direct patient care [19]. Our results also indicate that between the two specialties, hospitalists spend less time on direct patient care compared to EM physicians. This difference is likely due to the greater proportion of time hospitalists spend on documentation (22.5%) compared to EM physicians (15.8%).

Additionally, our study sought to quantify interruptions. EM physicians were interrupted roughly every 4.4 minutes and hospitalists every 11.3 minutes, consistent with published rates [20, 21]. The discrepancy in rate of interruptions between both specialties may have been due to workspace organization. At our facility, EM physician workstations are positioned close to the workstations of the rest of the care team. The proximity of EM physicians to other medical staff may allow for more interruptions because of visibility and background noise from medical and/or personal conversations. These interruptions may distract from the EM physician's current task. The EM workspace organization is in contrast with the work environment of hospitalists, who typically round on patient floors and utilize common area workstations for shorter periods of time. EM physicians and hospitalists also differed slightly in expected interactions with the care team, making interruptions by medical staff less common for hospitalists.

With physician burnout and depression rates rising [22], our survey attempted to address how direct versus indirect patient care and workplace disruptions impact physician job satisfaction. Results found that 69% of physicians would prefer increased time at the bedside, while 100% said they would like

Table 5: Survey respondents' preferences for time allocation in percentages

	Much less	Less	Satisfied	More	Much more	N/A
Bedside care	0	0	41	47	12	0
Procedures	12	0	47	24	0	18
Chart review	18	41	29	12	0	0
Documentation	53	47	0	0	0	0
Electronic ordering	53	29	18	0	0	0
Travel	12	6	82	0	0	0
Discharge	0	24	35	0	0	41
Communication	6	18	53	24	0	0
Administrative	12	24	59	6	0	0
Personal time	6	0	53	41	0	0

to spend less time documenting. This finding is consistent with published literature, which reports that physicians with lower satisfaction with the EHR were significantly more burned out [23]. While our study does not supply evidence that reducing computer time would improve job satisfaction, it does signal a negative view of indirect patient care from physicians at our hospital. Electronic orders and EHR documentation were the activities most disliked among physicians in our study; this represented 25.0% and 36.2% of the entire workday of EM and hospitalist physicians, respectively.

Through the survey, we also aimed to understand whether physicians' impressions of how they spend their time are reflective of reality, and we found that indeed this was the case. Physician estimations of proportions of time spent on direct care versus indirect care were similar to observed data. The perception of interruptions, however, suggests that physicians are interrupted less often than they think.

The EM physicians significantly overestimated interruptions ($p = 0.02$), suggesting that the frequency of interruptions actually experienced is particularly taxing on their workflow. Workplace interruptions may be a contributing factor to job dissatisfaction, stress, and inefficiencies in the physician's workload. Additionally, a study correlating physician job satisfaction with the pace of the work environment found that less chaotic environments were more satisfying [24]. Thus, interruptions experienced by EM physicians may have a significant impact on not only work performance, leading to errors with potentially fatal consequences, but also on level of burnout.

There were several limitations to this study. First, this study only included a small number of participants from one hospital. Second, our study was conducted in July 2020 during the COVID-19 pandemic. Our survey results showed that 68% of physicians felt that COVID-19 affected the way they allocated their time at work. The presence of COVID-19 patients, mandatory COVID-19 testing for all admitted patients, and increased PPE precautions likely affected the amount of time participants allocated to direct versus indirect patient care. Thirdly, while observers maintained a minimum distance of five feet from participants at all times, the Hawthorne effect may have impacted workflow. Finally, we were unable to capture time spent finishing documentation outside of the workplace, as some physicians complete their documentation at home. As such, total working time spent on documentation may be underestimated in this study.

CONCLUSION

This study attempts to quantify two frequently cited sources of physician dissatisfaction: time spent on indirect patient care and interruptions. We found that despite a desire to spend more time at bedside and less time interfacing with the EHR, our subjects spent about twice the amount of time on indirect patient care as on direct care. Historically, efforts by the medical community to decrease time interfacing with the EHR and decrease interruptions have been meager at best. To address the pressing issue of physician burnout, future studies should look at interventions targeting improvement in these metrics and measure their effect on job satisfaction.

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