

A Study of Emergency Physician Work and Communication: A Human Factors Approach

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Abstract:

Objectives: A time and motion analysis of emergency physician (EP) function was conducted. The primary endpoint was to characterize emergency physician (EP) time utilization and patterns of interruption. A secondary endpoint was to identify correlates of interruptions.

Methods: A physician observer shadowed 11 EPs and documented physician tasks in a standardized manner. This was a nonrandomized convenience sampling over 16 periods of approximately six hours each, including days, evenings, overnights, weekdays and weekend shifts. Statistical analysis was performed using SPSS and SAS. Correlations were identified using Spearman's Coefficient and verified using Fisher's exact test.

Results: EPs ranged in age from 29-55, and reported 1-35 years in practice and diverse certifications. 2,889 tasks were characterized by duration and 13 activity types over 5,507 minutes (approximately 92 hours). EP time was devoted primarily to patient interaction (27.7 %), chart review and entry (16.7 %) and computerized data retrieval and entry (11.8 %). EPs were interrupted 400 times (approx every 13.8 minutes). 9.75 % of interruptions required a transit of 3 meters or more, often across the department. The most frequent sources of interruptions were nurse (53.7 %), physician (31.8%), and family member (5.8 %). The rate of interruption was correlated with shift intensity, as measured by average delay from patient registration to EP assessment (P=0.0005).

Conclusions: EPs devote considerable time to nonclinical tasks. EP interruption rate increases as shifts become busier. As failures of communication are a frequent source of errors in complex systems, attention should be devoted to optimization of communication in the ED.

MeSH WORDS: Interruption, Communication, Emergency, Task, Human Factors

Introduction

The "person" approach to human errors focuses on actions and errors of individuals, and views unsafe acts as arising primarily from aberrant mental processes such as forgetfulness, inattention, poor motivation, carelessness, negligence, and recklessness. A "systems"

approach looks at the individual as part of a system, and is premised upon the notion that humans are fallible and errors are to be expected. Errors are seen as consequences rather than causes, having their origins in "upstream" systemic factors. Countermeasures are based on the assumption that we cannot change the human

condition, but can refine the conditions under which humans work.^{1 2}

Importance:

Critical thinking and analysis get lost in an interrupt-driven workplace.³ Lapses in attention associated with interruptions and distractions have been associated with nearly half of aviation accidents attributed to crew error,⁴ and with more than 15 % of all nuclear plant shutdowns.⁵

The nature of communication in the ED may vary from organized and deliberate under controlled conditions, to chaotic during periods of stress and multitasking. Information transfer may vary due to a lack of standardization in the transition process, and from inherent difficulties with the degree of certainty attached to particular diagnoses.⁶

In a prospective observational study of reported errors in a busy academic emergency department, Fordyce et al categorized 12 % of errors as primarily related to communication. These included difficulties in contacting the appropriate person, incomplete or inaccurate information from an external department, miscommunication between ED staff, miscommunication between ED staff and patients, and misidentification of patients.⁷

Goals of This Investigation

In this study we sought to characterize EP function by time and task, and to characterize patterns and correlates of EP interruption. Last, we review potential areas for optimization of ED communication.

Methods:

Study Design: This was a prospective, observational time-motion task analysis of emergency physicians. Data was collected in sixteen six hour observation periods that included days, evenings, overnights and both weekdays and weekends. These periods were nonrandomized, but were arranged to provide a representative sampling of shifts.

Study Setting and Participants: The study was conducted in the ED of Toronto General Hospital. This is a twenty-eight bed, quaternary care teaching hospital ED that treats approximately 28,000 patients per year. The

hospital is a major transplant, cardiology and oncology center, and the ED services a high acuity patient population. There is one staff physician on duty for 14 hours per day, and double physician coverage for ten hours per day. Medical students and interns are present in the ED during emergency department rotations, and a nurse practitioner sees low acuity patients during most weekday hours and reviews them with the EP.

Methods of Measurement: Using a standardized data collection form, an observer recorded in one minute intervals emergency physician time utilization and nature of physician interruptions. The observer (R.E.) remained static in a central fixed position in the ED where he could observe and overhear most EP action. The data sheet was obscured from the physician's view at all time. EPs were aware that they were being observed and encouraged to inform the observer when they were engaged in personal action (personal phone call, lunch), but the observer did not otherwise engage the EP in conversation. The EP remained within the observer's view except when in a curtained patient cubicle, or out of the department for personal activities. Physician time utilization was categorized by 13 activity types (see Table 1).

Data Collection and Processing: EP activity was tabulated by duration and activity. EP interruptions were tabulated by source of interruption (ie. nurse, patient family member), and physical activity by physician (how far physician had to walk) in response to the interruption. The observer endeavored to capture brief events that occurred during EP multitasking, and events lasting less than one minute were recorded as one minute in duration. Tightly clustered or simultaneous interruptions – i.e. two nurses interrupted an EP at once – were recorded as one interruption. The distance a physician had to travel in response to an interruption was categorized as static (0 – 1 meter), short (1 – 3 meters), or long (> 3 meters). “Physician Delay” was defined as the average period from patient registration to EP assessment during the observation period.

Ethics: This study was approved by the hospital Research Ethics Board. All emergency physicians recruited provided written informed consent for participation in this study.

Table 1 – Categorizations of Physician Activity - Definitions

Patient	Any time interacting directly with patient
Family	Time interacting with family member (away from bedside)
Data	Time spent entering or retrieving data from the ED computer system
Chart	Time spent reviewing or completing the patient chart
Nurse	Time spent interacting with nurse.
Teach/Review	Time spent interacting with any resident or medical student working in the ED directly with the EP
Consult	Time spent interacting with physicians not working in the ED directly with EP
Clinical Other	Any individual or entity not fitting into any of the aforementioned categories
Non Clinical	
Comp/Tech Diff	Any problem to do with the computers. In the case of interrupts, the problem had to occur during and directly interfere with an ongoing task.
Admin/Page	Answering a page; being called to do administrative work such as forms; tasks that were bureaucratic in nature.
Inventory	Searching for equipment or inventory
Non Clinical Other	Any individual or entity not fitting into any of the aforementioned categories
Personal	Personal Activity.

Primary Data Analysis: Statistical analysis was performed using SPSS and SAS. Correlations were identified using Spearman's Coefficient and verified using Fisher's exact test.

Results:

Physician Activity

Study subjects comprised 11 emergency physicians ranging in age from 29 – 55, reporting from 1 – 35 years in practice and diverse levels of board certification. Observational data was collected for a total of 5507 minutes (approx 91.8 hours). 2889 tasks were characterized and categorized by 13 activity types

Emergency physician time was devoted primarily to direct patient interaction (27.7 %), chart review and entry (16.7 %), and computer data retrieval and entry (11.8 %). Interaction with students and house staff for informal teaching and case review represented 5.8 % of time, and interacting with consultants represented 8.6 % of time.

Emergency physician activity, stratified by number of discrete tasks, was devoted primarily to charting (24.4 % of tasks), nurse interaction (19.4 %), computer access (16.0 %), and patient interaction (14.9 %). (See Table 2)

Interruptions

EPs were interrupted 400 times. This equals approximately every 13.8 minutes, or 4.4 interruptions per hour.

The nature of interruption was characterized for 378 interrupts. The most frequent sources of interruptions were nurse (53.7 %), physician (31.8 %) and family member (5.8 %). (See Table 3).

Interruption Rate: ANCOVA

Delay to physician assessment was positively associated with interruption rate; as delay to EP assessment during an observation shift increased, so did frequency of EP interruptions interruption rates. (P=0.0005).

Table 2 – Categorization of EP Activity by Time and Task

Activity	Time (minutes)	Time (%)	Unique Task (n)	Unique Task (%)
Patient	1524	27.7	429	14.9
Family	69	1.3	53	1.83
Computer	651	11.82	461	16.0
Chart	921	16.7	704	24.4
Nurse	426	7.74	560	19.4
Teach / Review	317	5.76	151	5.23
MD Consult	475	8.63	299	10.4
Clinical Other	17	0.31	2	0.07
Technical	41	0.75	18	0.62
Admin / Page	102	1.85	56	1.94
Inventory	40	0.73	25	0.87
Nonclinical Other	31	0.56	26	0.90
Personal	893	16.2	105	3.63
Total	5507	100	2889	100

Table 3 – Nature of Interruptions

Nature of Interruptions	(N)	Percent (%)
Patient	20	5.29
Family	22	5.82
Nurse	203	53.7
Consulting MD	96	25.4
ED Student / House staff	24	6.35
Clinical Other	1	0.26
Technical	1	0.26
Admin / Page	7	1.85
Nonclinical Other	1	0.26
Personal	3	0.79
Total	378	100

Physician Ambulation in Response to Interruptions

87.5 % of interrupts required little movement on the part of the physician (i.e., a nurse approaches a physician to request a medication order.) 9.75 % of interrupts required a transit of 3 metres or more, often across the department. (For example, a physician in the suture room may respond to an overhead page to attend in another part of the ED.)

Discussion:

We are aware of no other study that has used average time from patient registration to first physician assessment as a measurement of shift intensity. EP's work harder, faster and multitask more in response to increasing patient wait time. Increased multitasking and workload increases vulnerability to distraction and error. In this study, as physicians became busier (i.e. physician assessment more delayed), they were also interrupted significantly more frequently. More judicious communication on the part of nurses and fellow medical staff may be called for during periods of heightened shifts intensity.

Physicians performed approximately 31.5 tasks per hour, and were interrupted approximately 4.4 times per hour. In a time-motion analysis of EP function in an urban teaching hospital, Hymel and Severyn reported an average of 4.76 interruptions per hour.⁸ In a study comparing workplace interruptions in emergency departments and primary care offices, EPs were interrupted nearly 3 times more than their primary care counterparts.⁹ Chisholm et al reported that EPs performed approximately 22.5 tasks per hour, and were interrupted approximately 17.2 times per hour.¹⁰ Coiera et al reported that 10 % of communication time involved two or more concurrent conversations.¹¹

In our study, interrupts that occurred in clusters or simultaneously were categorized as one interruption, and this may account for lower interruptions rates than in other observational studies in the ED. Reported differences in interruption rate might also relate to systemic differences in study sites, such as patient and

doctor staffing, and to methodological differences. In Chisholm's study, an observer

shadowed EPs and followed them to all locations except the washroom or when either the physician or the patient specifically requested privacy.¹² In a brief pilot of the study, we found this approach unworkable; several emergency physicians began to voice strong objection to being closely "shadowed" by an observer with a clipboard. Concerns regarding the Hawthorne effect and physician attrition caused us to position the observer in a central location in the department. (See: limitations).

Communication: Problems and Strategies

Suboptimization of communication occurs when clinicians, despite their own disinclinations to be interrupted, initiate communication without thought of the impact of the request on the other party.¹³ In our study, approximately one half of physician interruptions were from nurses (53.7 %), and approximately one third (31.8 %) were from other physicians. While we did not distinguish between medically necessary interruptions and unnecessary ones, it is clear that a proportion of interruptions are of a personal or administrative nature, and unrelated to patient care.

Approximately 10 % of interruptions required physicians to change location in the department. In our ED one way paging is used extensively, but not two way intradepartmental telecommunication such as intercom or personal handsets. There are few constraints on nurses or clerical staff regarding calling an EP, and a physician may leave a wound repair to attend a query at the front desk regarding a clearly deferrable matter.

Vincent categorizes others problems of communication: Communication may be omitted, such as when a nurse or physician fails to pass information to their counterpart. Semantic ambiguity occurs when the same phrase is correctly sent and received, but interpreted differently by the two parties. Phonetic or lexical ambiguity refers to the problem of sound-alike terms or drugs. The volume of communication may overload the

capacity of the recipient to manage it, and clinicians may forget or ignore communication.

Dysfunctional approaches to “communication overload” may be adopted, such as a resident ignoring a first page, with the presumption that truly important communications will result in a second page.¹⁴

Communication training may focus on giving precise information according to a standard format, and stressing the potentially distracting effect of the information on the other person. Team-based interventions might include restrictions on interruptions when information might be easily available in written form. Restrictions on communication and interruption at certain critical phases of procedures could be modeled after “sterile cockpit” rules that prohibit unnecessary conversation during takeoff and landing.¹⁵

Increased use of asynchronous communication tools such as email, voice mail, and white boards are suggested, as are communal communication tools such as and message boards.¹⁶ Improved synchronous communication could include use of two way intercoms and personal handsets for communication across the ED.

Limitations

In order to diminish the impact of observation, the investigator remained static at a workplace in the center of the ED. As physicians were not observed behind curtains, there could be an *overestimate* of the total time per shift spent on direct patient care and an *underestimate* of other tasks and interruptions. Simultaneous or closely clustered interruptions were ranked as one interruption, and this could also contribute to under reporting of interruptions.

As events lasting less than one minute were rounded up to one minute, there may have been overrepresentation of time spent on typically very brief actions. A lower than expected rate of EP interruption may suggest measurement error on the part of the observer.

There is potential for nonrandom shift sampling to have introduced bias. The observation periods

occurred during a four week time period from mid January to mid February – and may not have

been representative of the year as a whole. This study was done in the Canadian single payer

health care setting, and may not be generalizable to other countries.

Other indices have been used, including numbers of concurrently managed patients, number of staff working at one time, and numbers of simultaneous tasks.¹⁷ In future studies we hope to analyze factors that might increase or minimize interruptions, and to link interruptions with errors.

Conclusions:

Emergency physician interruption rate increases as shifts become busier and potentially more hazardous. While interruptions may be inherent to the culture and practice of emergency medicine, consideration must be given to the potential for error attributed to this phenomenon. Attention should be devoted to EP task delegation and optimization of communication in the ED.

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Competing interests: None Declared
Funding: None

This manuscript has been peer reviewed.

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