Physician Workflow in Two Distinctive Emergency Departments: An Observational Study

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Abstract

Objectives We characterize physician workflow in two distinctive emergency departments (ED). Physician practices mediated by electronic health records (EHR) are explored within the context of organizational complexity for the delivery of care.

Methods Two urban clinical sites, including an academic teaching ED, were selected. Fourteen physicians were recruited. Overall, 62 hours of direct clinical observations were conducted characterizing clinical activities (EHR use, team communication, and patient care). Data were analyzed using qualitative open-coding techniques and descriptive statistics. Timeline belts were used to represent temporal events.

Results At site 1, physicians, engaged in more team communication, followed by direct patient care. Although physicians spent 61% of their clinical time at workstations, only 25% was spent on the EHR, primarily for clinical documentation and review. Site 2 physicians engaged primarily in direct patient care spending 52% of their time at a workstation, and 31% dedicated to EHRs, focused on chart review. At site 1, physicians showed nonlinear complex workflow patterns with a greater frequency of multitasking and interruptions, resulting in workflow fragmentation. In comparison, at site 2, a less complex environment with a unique patient assignment system, resulting in a more linear workflow pattern.

Conclusion The nature of the clinical practice and EHR-mediated workflow reflects the ED work practices. Physicians in more complex organizations may be less efficient because of the fragmented workflow. However, these effects can be mitigated by effort distribution through team communication, which affords inherent safety checks.

Keywords

- clinical workflow
- emergency medicine
- electronic health records
- complexity
- patient safety

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Background and Significance

Intensive work and time pressures in health care can put clinicians at risk for compromising their own and patients' safety. This risk is exacerbated in high-intensity environments, such as emergency departments (EDs), where additional pressures arise because of emergent care requirements under severe time pressure. Increased stress arising from the work environment can result in poor ED physician experience, potentially contributing to errors and poor quality of care.[1] Using the vocabulary and concepts of complexity theory, ED—more so than other settings—can be described as a complex system.[1] Domain complexity of health care practice is an important factor to consider for patient safety and quality.[2]

ED clinicians have multiple simultaneous demands being made with competing priorities, where the next step in the decision process for a patient's condition is not always predictable. With new patients entering ED or changes in existing patients' conditions, clinicians experience frequent interruptions that require them to continue the reprioritization of tasks. These events typically occur under time pressures and incomplete patient information, adding to the system complexity.[3]

Dealing with complexity appears to be a way of life in the ED, and emergency physicians have developed various strategies for managing that complexity.[4,5] ED is situated within the hospital's sociocultural or economic boundaries, the local community, or even within the greater health care system, all of which interact and influence the behavior and work patterns in the ED.

In academic EDs, interruptions and quick task transitions are observed at twice the rate of community settings.[6] Such demands on ED clinicians could be offset by technology, such as electronic health records (EHRs), supporting task efficiency and accuracy. In addition to documentation support, clinicians' EHR use is also known to aid in achieving other important goals, such as communicating with team members and synthesizing large amounts of information.[7] However, literature suggests that the introduction of EHRs has not always considered the nature of work in the ED, resulting in transformed and suboptimal workflow leading to substantial frustrations with the systems.[8,9] In the United States, studies investigating the impact of EHRs on clinical workflows suggest that the documentation has increased over the last decade, with 50 to 65% time spent on EHR-related activities.[6,10–12] Unlike other settings, EDs are unable to regulate their volume and need to bolster efficiency during peak patient loads.[6,13] Since many EHRs are optimized to support documentation as an uninterrupted process, the mismatch between EHRs and ED environments can lead to clinical workflow fragmentation. Workflow fragmentation describes the frequency of clinician task transitions, which are associated with inefficiencies and workarounds that may lead to medical errors that compromise safety.[10,14]

Our study provides insights into the organizational aspects affecting physician performance, including the match between the task complexity and workflow, and potential for errors. The nature of these tasks and the cognitive pressures physicians encounter within two different organizational structures can provide insights about what pressures push the physicians toward the boundary of compromising safe practices, generating errors.[15,16]

Objectives

The goal of our study is to characterize and model physician workflow in two distinctive urban EDs with different levels of complexity. Physician practices within these organizations, mediated by two different EHRs, are explored within the context of organizational complexity for the delivery of care.

Increased complexity in the environment is shown to be related to increased cognitive load, where insufficient allocation of cognitive resources is available for completing necessary tasks, adequately and, possibly, safety.[17]

Methods

Study Sites

This study was conducted at the two representative EDs of Icahn School of Medicine at Mount Sinai, NY (site 1) and Mayo Clinic, AZ (site 2) (►Table 1 for site demographics). These EDs serve different patient populations and have distinct models of care delivery.

Site 1 ED utilizes a split flow design such that patients are sent to specific areas based on their acuity level upon entry.[18]

Table 1 Emergency department demographics at two sites

Demographic	Site 1	Site 2
Type	Urban, academic setting with no trauma designation	Urban, nonacademic setting with no trauma designation
Staffing	Attendings, residents, PAs, nurses	Attendings, ED and non-ED residents, nurses
Consultation services	All surgery/medical subspecialities available	All surgical/medical subspecialities available except trauma surgery
Patient population	Underserved, inner city, and primarily low-income priority population	Existing patients seen at the hospital
Annual patients served	100,000	33,000
Hospitalizations originating from the ED	27%	50%

Abbreviations: ED, emergency department; PA, physician assistant.

After this distinction, physicians self-assign patients to themselves in the EHR. Site 1 ED has two acute care areas with physician workstations centralized and surrounded by nurses' workstations (►Supplementary Figure S1 [available in the online version]). Patient beds line the walls of these areas. In each acute area, the medication room is located between the physician and nurse workspace, and a supply closet is found next to the nurses' stations for convenient access. Patients may enter the ED from the ambulance bay or the intake entrance area. Two exits lead patients back through the intake entrance area.

Site 2 follows a linear model where most patient tasks are completed and updated before proceeding to the next case. To increase efficiency and reduce the ED length of stay, site 2 utilizes a rotational assignment system employing a predetermined algorithm assigning patients to physicians or teams rather than self-assignment of patients.[19] At the start of a shift, each physician is assigned to the first four incoming patients. From the fifth patient onward, patients are consecutively assigned among all on-call physicians.

Site 2's ED is divided into three color-coded zones (►Supplementary Figure S2 [available in the online version]). Like site 1, physician and nurse workstations are centralized and situated in proximity, with patient beds lining the ED walls. Physician workstations are located with easy access to all three zones, whereas each zone has its own nurses' station. Two medication rooms and supply closets are located close to nurses' stations for convenient access. There is an exit near the hospital radiology department to move patients for diagnostic tests. Like site 1, patients may enter the ED from the ambulance bay or intake entrance area. After a bed is assigned to a patient, a nurse is also assigned in the same zone (e.g., patient in zone "red" is assigned nurse in zone "red"). Both sites utilize different commercial EHRs and offer an 8-hour EHR training to clinicians.

Researcher Positionality

Our team approached the present study with multiple levels of expertise and connections to the research settings. Four co-authors have the knowledge and experience in the biomedical informatics and emergency medicine fields, and the two clinician co-authors are senior attendings in the EDs under investigation. As such, we experienced an accelerated establishment of trust between physician participants and researchers, as we worked together as a team. To reduce potential biases related to our established connections, only two co-authors were directly involved in recruitment and the primary data collection at the EDs, whereas the remainder of the team engaged solely in data coding, analysis, and interpretation of results. As such, our chosen position in relation to the study settings and participants are both outsider and insider with substantial knowledge of the study contexts.

Participants

All physicians received information about the study purpose, the nature of the proposed observation, and were invited to participate in the studies during presentations at bi-weekly faculty meetings. The New York Academy of Medicine, Icahn School of Medicine at Mount Sinai, and Mayo Clinic institutional review boards approved this study. All invited participants were board-certified by attending physicians, who agreed to participate and provided written consent.

Data Collection: Observation and Shadowing

Two co-authors were trained to observe the workflow and shadow participating physicians unobtrusively. The researchers noted the layout of the ED, including information on general workflow patterns (e.g., patient pathways from entry to discharge). They recorded notes on the nature of the tasks attempted during clinical activities and the role of EHRs in completing them. The observers' notes included the specific time, location, and type of clinical activity or interaction. A list of clinical activities with definitions and illustrative examples are shown in ►Table 2. The researchers kept specific records on instances of multitasking when physicians engaged in two or more distinct tasks (e.g., reviewing patient EKGs and listening to outgoing physicians' description of other patients) and interruption when physicians' activities were halted due to physical or verbal interruption from another clinician.

A standardized MS Excel template was used to capture observation notes. For each session, the shadowed physician was assigned a pseudonym (e.g., physician 1), and information that could be traced back to that physician was de-identified, including interactions with other providers. De-identified field notes were uploaded to an encrypted USB drive to ensure security.

Data Analysis

A comprehensive coding scheme was developed for qualitative analysis. Descriptive analyses were used to classify the quantitative elements of the observed workflow. These quantitative analyses allowed us to visualize workflow using timeline belts as reported in Zheng et al and Abraham et al.[14,20,21] Timeline belt is an analytical method for quantifying time and task patterns in clinical workflow.

Coding Scheme Development

Two co-authors independently applied the thematic analysis approach for analyzing qualitative data to two shadowing sessions.[22,23] Following Larcos et al, shadowing sessions were evaluated line by line for our initial macro-codes of EHR use, team interactions, and patient care.[23] Preliminary coded data were reviewed by two co-authors (C.D.H. and H.C. S.) to develop a provisional coding scheme, deductively with both macro- and micro-codes. There was a 95% overlap across the two coders, showing a high degree of agreement. Disagreements were resolved through discussion to achieve consensus. The final codebook included 22 codes (►Table 2). The remaining 12 sessions were subsequently coded, inductively with this codebook. Illustrative examples of coded excerpts of physician workflow at each study site are given in ►Supplementary Figures S3 and S4 (available in the online version).

Table 2 Task classification codebook of emergency department physicians

Micro task category	Definition	Illustrative examples
Macro task category: EHR use		
EHR documentation	Data entry into EHR, including details about patient encounters	P2 documents resident's description of patient 10's condition. Incoming physician adds comment regarding ENT consult.
EHR review	Evaluation of patient history and details	P6 opens patient record to review vitals, but patient's temperature is missing (delay). During call, incoming physician, referring to concerns, cause and consult with specialty department.
EHR navigation	Movement within the EHR to locate information	P3 logs into EHR. Incoming physician searches for ultrasound order in EHR but is unable to find order.
EHR orders	Submitting and accessing medication or test orders	P8 orders patient medications and tests in EHR. Incoming attending physician places order for pain medication following speaking to nurse.
Dictation (only at site 2)	Data entry via dictation where physicians call in information to later be recorded by medical scribes in EHR	P10 has dictation call for patient in room 22.
Macro task category: paper system		
Review	Review of paper charts	P8 looks up the paper chart for the new assigned patient. P10 looks over paper charts of other assigned patients.
Documentation aid	Paper chart used as a memory aid for possible transfer of information into EHR/dictation	P8 reviews record printout with notes for patient medications. P10 transfers patient 1 details to paper.
Macro task category: patient care		
Direct care	Direct patient care	P4 speaks with patient 2. P10 asks patient about current condition and home treatment.
Indirect care	Tasks related to patient care which may not occur in patient room	P2 signs EKGs provided by nurse. P10 signs required charts for all patients assigned.
(delay)	Care is delayed due to external factor, such as unresolved laboratories or inaccurate patient location listed in EHR	P2 unable to locate patient 5 or nurse to ask for help locating patient. Secretary looking for P14 but not at station. Left message.
Macro task category: team communication		
Handoff	Transfer of knowledge from outgoing attending to incoming attending physician	Outgoing attending describes patients from their shift to P6.
Consultation	Clinician calls specialist to discuss patient case	Resident approaches P6 for consultation. P10 makes a phone call to consult with oncologist specialist regarding patient treatment.
Transfer of knowledge	Any patient-related discussion with a direct team member	Nurse asks P8 if they have extra pair of shoes for patient and for a social work referral. Resident assigned to the ED enters the room and discusses the patient with incoming attending physician.
Social	Any personal activity, such as nonpatient-related conversation	Three attending physicians talk about P8's birthday. P10 chats with other doctors as their shift does not start until 10 am.
Administrative	Work-related communication, emails, or paperwork	P3 attends faculty meeting. P14 asks questions about scheduling.
Macro task category: potential sources of error		
Environmental distraction	Any noise or external disturbance from task	A loud stool falls over and all staff stop to identify the origin of the noise (P4). P14 looks up emails, the environment is busy and there are a lot of disturbances in the surroundings.

Table 2 (*Continued*)

Micro task category	Definition	Illustrative examples
Interruption	Current activity is paused due to verbal or physical interruption	Nurse interrupts P1's her documentation to ask about deceased patient. P14 has argument with physician on phone as specialty physicians cut him in between and did not allow to finish his questions.
Correction of interruption	Clinician resumes activity which they were doing prior to interruption	After handover interruption, P6 and outgoing attending physician resume handoff.
Multitasking	Clinician undertaking multiple tasks simultaneously	P8 reviews stack of EKG's and EHR trackboard as outgoing attending physician describes patient. P10 has dictation call for patient in room 11.
Macro task category: other		
In transit	Work-related movement between locations	P7 and resident walk to workstation after visiting patient. P10 goes to see patient in room 11.

Abbreviations: ENT, ear, nose, and throat; EHR, electronic health record; P, physician.

Calculations of Time Allocation

Using MS Excel software, descriptive analyses were performed to classify the session time, the number of tasks, time spent on tasks, and time spent at various locations. A general workflow model for each site was constructed, capturing the task order and location using the Lucid Chart software.[24,25] The average rates of interruptions and multitasking per hour were calculated.

Temporal Order of Clinical Activities

During observations, identification of task interruptions from external agents, included receiving a phone call, reacting to alarms and alerts, or interacting with a clinician from another team. To visualize how multitasking and interruptions impact the observed workflow, we created timeline belts representations using Lucid Chart software.[14,25]

Each physician observation is symbolized by a row (belt), depicting a specific clinical task, and interruption or multitasking instances. Clinical and administrative tasks were classified into three categories, and physical movements of the physicians were depicted as "in transit," any social interactions as "social," and any administrative tasks as "administrative."

Results

Fourteen physicians ($n = 14$; site 1 = 9; site 2 = 5) were shadowed. The mean EHR experience of participants at site 1 was 6.7 ± 1.4 years, and at site 2 was 7.3 ± 3.9 years. Between December 2014 and September 2016, a total of 62 hours of shadowing, lasting 60 to 324 (mean = 170) minutes, were conducted on weekdays between 07:00 A.M. and 8:30 P.M. See ►Fig. 1 for a breakdown of the sessions. At both sites, we spent approximately the same time shadowing physicians during the afternoons and early evenings. At site 1, we spent more time observing physicians during the morning shift, and at site 2 more time was spent during the afternoon shift.

Time Spent by Physicians on Clinical Activities, by Task

Data from the shadowing sessions were characterized by three main activities: updating patient records, team communication, and direct and indirect patient care. ►Fig. 2 shows the distribution of time spent per task.

Time Spent on Clinical Activities, by Location

Most clinical activities occurred at the workstation, nurse's station, and patient bedside. Site 1 physicians spent 61% time at the workstation, followed by 26% at the patient bedside. The remaining time was spent in hallway discussions (6%), administrative office (2%), diagnostic laboratory (0.3%), or other locations for meetings (16%). Site 2 physicians spent approximately 52% of time at the workstation, followed by 27% spent at the patient bedside. The remaining time was spent at the nurse's station (4%), hallway (3%), or the diagnostic laboratory (0.3%). To better understand the relationship between locations and tasks, we constructed a general workflow model for each site.

We captured the physician workflows at the two sites. Similar steps in the workflows are highlighted by using the same colors. The site 1 workflow (►Fig. 3) comprised of these steps:

- The attending physician self-assigns a patient.
- Residents present the patient's case to the physician while the attending physician reviews the patient record on the EHR and documents details of the presentation. This step was unique to site 1 due to the lack of formal teaching activities at site 2 (highlighted in purple).
- Next, the attending physician assesses the patient. If accompanied by a resident, there may be some communication at the bedside.
- From here, the physician may visit other patients before returning to the workstation or directly to the workstation.
- When the physician returns to the workstation, they document patient encounters or submit orders for tests.

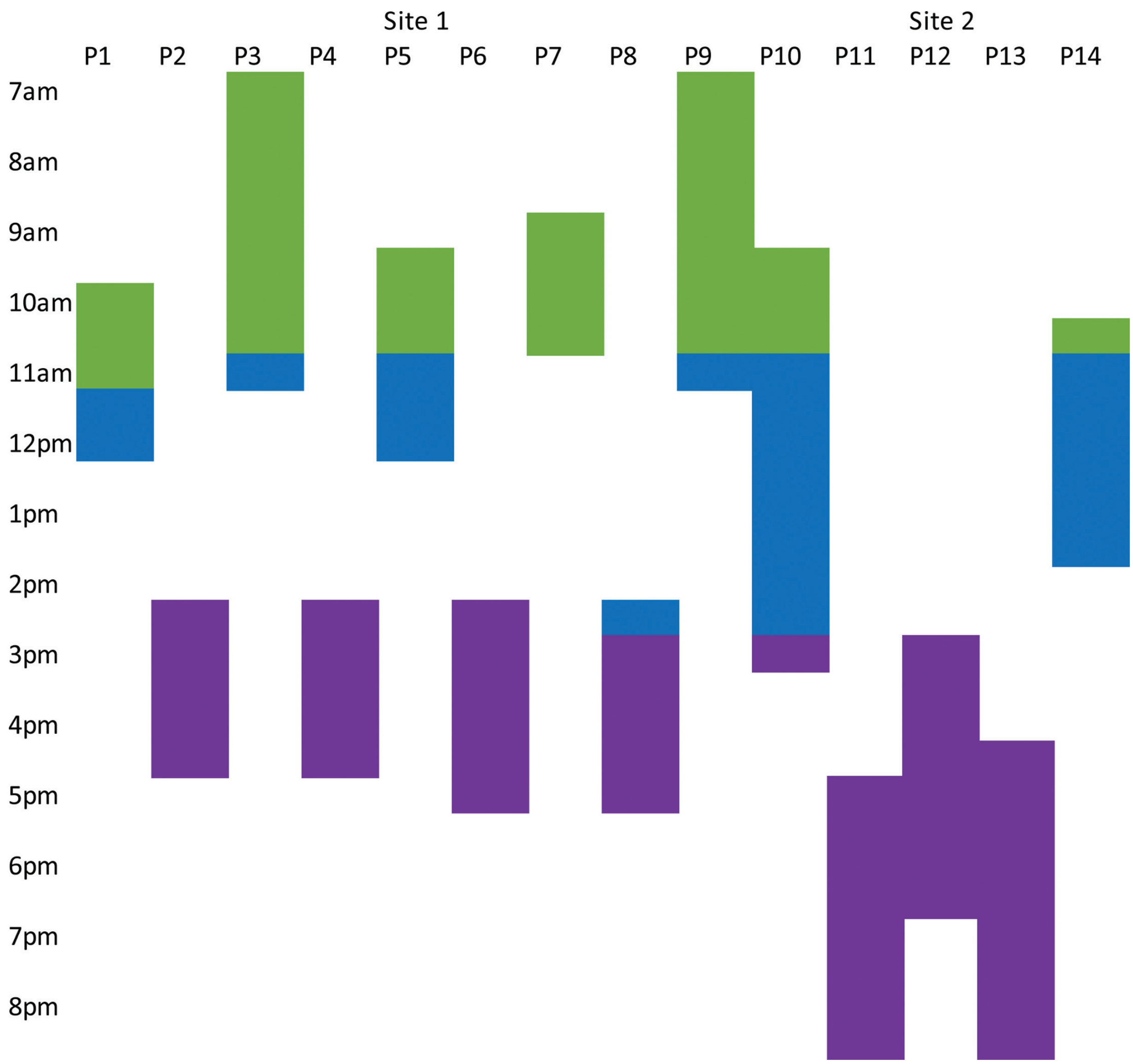

Fig. 1 Distribution of shadowing sessions at each study site.

- As information becomes available, the physician reviews patient records, communicates with team members, and documents these communications if needed (6a). Steps 2 to 6a may have happened many times before disposition occurred. The attending may have also been assigned new patients in between.
- Once disposition is set, the physician completes documentation for discharge, including prescriptions.
- Lastly, the attending hands over to the resident or assigned nurse for patient transfer/discharge.

The site 2 workflow (►**Fig. 4**) comprised of these steps:

- Physician is assigned to a patient.
- The attending physician reviews the patient record.
- The physician places initial diagnostic and medication orders based on the review. This step differs from site 1's practices as site 2 physicians preferred to place initial orders before visiting the patient (step 4) compared with step 3 in site 1 workflow.
- The physician visits the patient for assessment.
- Optionally, the physician may check-in on other assigned patients before returning to the workstation, although not a norm.
- When the physician returns to the workstation, they may document or submit tests or medications orders, as necessary. Attendings may modify orders placed in step 3. Also, the attending physicians communicated (step 6a) with the care team and other consulting physicians, as necessary.
- Once results from the orders placed in step 6 are available, the physician reviews the results and continues care.
- The attending documents the patient encounter notes using the EHR system or phone dictation service. As highlighted in green, this step is unique to site 2, as dictation services are not available at site 1, and documentation is distributed between residents and attending physicians. Steps 2 to 8 happened many times before disposition occurred. Physicians may also have been assigned new patients in-between.

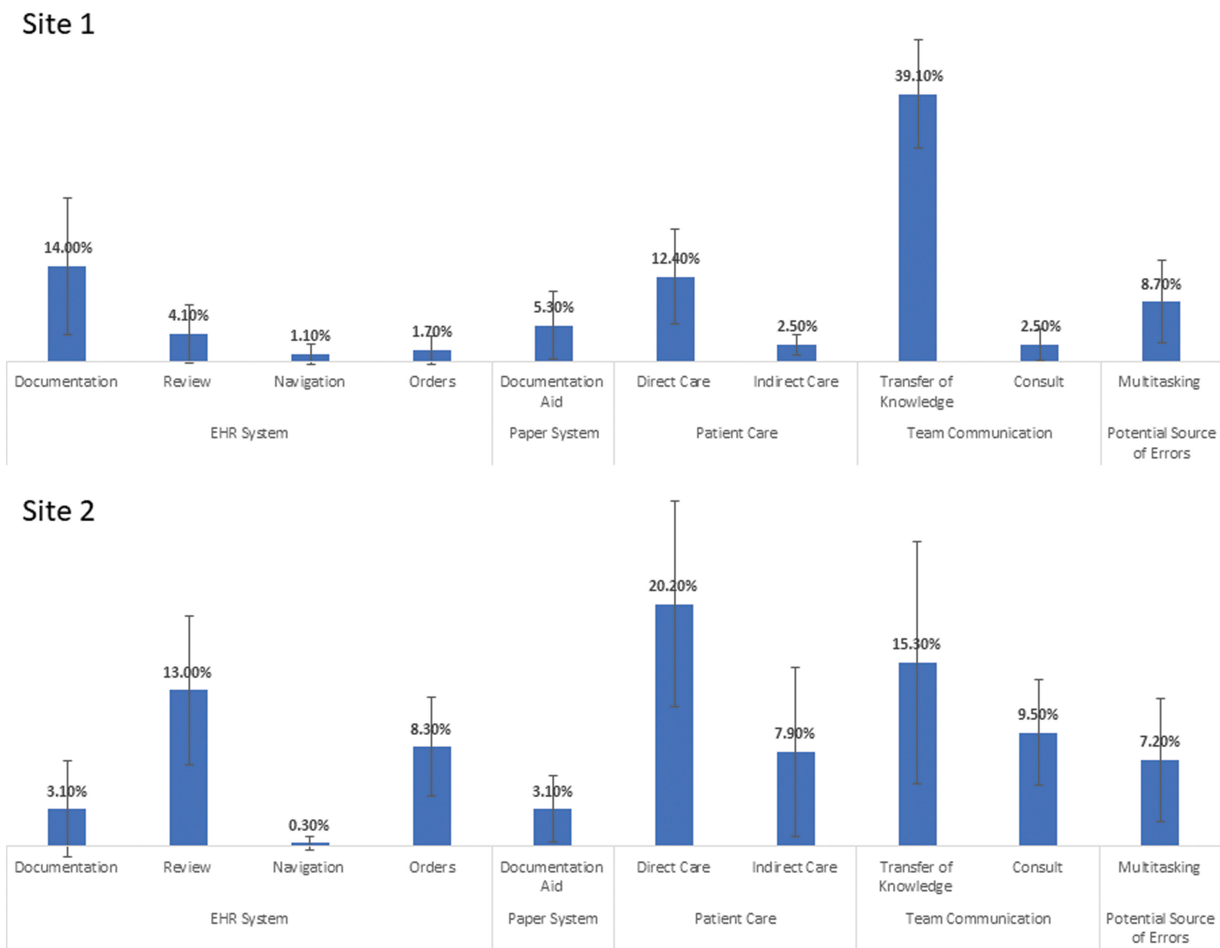

Fig. 2 Percentage time spent on various clinical tasks in the two emergency departments.

- Once disposition is set, the attendings complete discharge documentation, including prescriptions.
- Finally, attending hands over to the nurse the patient transfers/discharge information.

Interruptions and Multitasking

Physicians at site 1 had 2.6 interruptions/hour. These primarily occurred during team communication when the physician was "interrupted" by another clinician working on a different patient case or during the documentation process. At site 2, one interruption/hour was observed, most of which occurred during communication with other clinicians, mostly nurses. All interruptions were short (1–3 minutes).

Temporal Order of Clinical Activities at Two Sites

The frequency of task transitions is presented in ►Fig. 5 as a visualized form of the temporal order of clinical events. At site 1, frequent task transitions were observed throughout shadowing sessions. Team communication usually occurred before and after other clinical activities, and frequently in combination with EHR documentation. Multitasking primarily occurred at the beginning or about two-thirds of the way through shadowing sessions. Instances of interruption were distributed throughout the session.

At site 2, fewer transitions between tasks were observed. EHR use was frequently followed by patient care and brief team communication. Instances of multitasking were observed as confined to the first half of the shadowing sessions.

The distribution of time spent per patient and the temporal order of care is presented in ►Fig. 6. Site 1 physicians were observed to switch back and forth between patients more frequently than site 2 physicians. Physicians at site 2 most often completed all tasks related to a patient (or as many tasks as possible) before moving on to the next patient case. Generally, it was a model of one patient being seen at a time.

Discussion

EDs face many challenges including overcrowding, long length of patient stays, multitasking, distractions, and dealing with unexpected events. Given the complexity of such environments, it is difficult to work optimally. How can we streamline the current workflow to make it time efficient and at the same time provide effective delivery of care without compromising safety? In our study, we describe and characterize physician workflow in two distinctive urban EDs with different levels of workflow complexity.

Task Switching and Fragmentation

Clinical workflow at site 1 was characterized by team communication, where patient cases were discussed with trainees, and these interactions were documented in the EHRs.

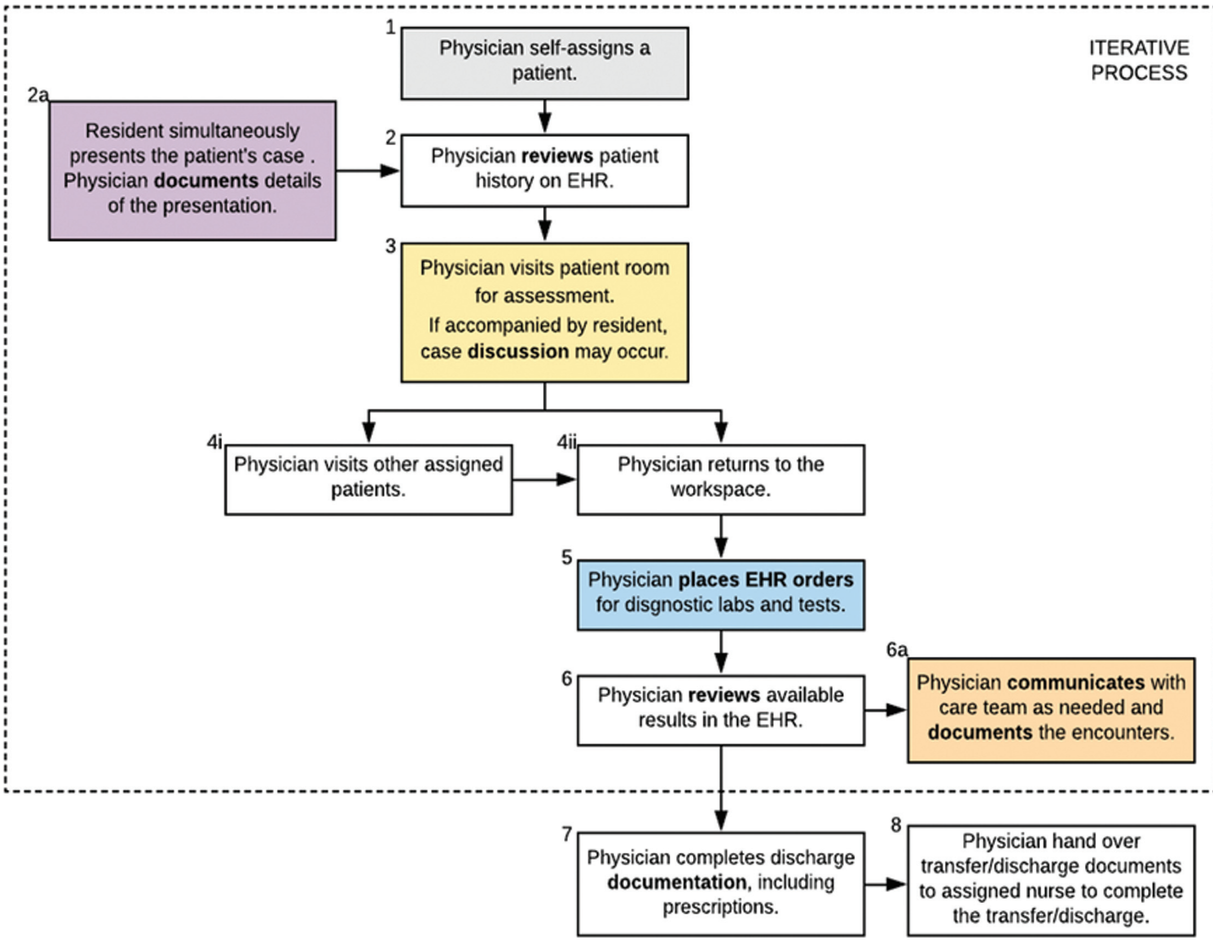

Fig. 3 Schematic site 1 physician workflow by location: arrows and numbers denote temporal order of activities and the dashed line box denotes iterative process. Solid line rectangles specify the nature of the physician activities.

There was a parallel processing of multiple patients' data with multitasking and interruptions interspersed between these clinical activities. Data visualization illustrated fragmentation of clinical workflow at this site.

Studies have suggested that interruptions can compromise memory and attention by requiring individuals to switch focus from one task to another.[26,27] Returning to a disrupted task requires completion of the interrupting task and then regaining the context of the original task. Multiple variables, including the characteristics of the primary task, the nature and length of interruptions themselves, and the environment itself, may influence the impact of interruptions on clinical tasks and errors.[27,28] Interruptions could also disrupt complex cognitive tasks potentially, requiring almost three times longer to resume effectively than simple tasks.[28,29] Studies also show that as tasks get more complex, people lose more time, showing time costs to be greater when the participants switched to tasks that were relatively unfamiliar.[30]

Thus, in busy interrupt-driven clinical environments, clinicians reduce the time they spend on clinical tasks if they experience interruptions and may delay or fail to return to a significant portion of interrupted tasks. Task shortening may occur because interrupted tasks are truncated to "catch up" for lost time, which may have significant implications for patient safety.[31,32]

Further studies that address a better understanding, the hidden costs of multitasking may assist ED physicians in choosing strategies that boost their efficiency. For the clinical informatics specialists, the challenge that lies ahead is to develop strategies to mitigate the negative consequences of interruptions, while enhancing the positive effects of delivering real-time clinical information.[33]

Team Communication and Error Checks

There is a close relationship between competency in the delivery of patient care and the need to minimize errors. This is juxtaposed with the competing demand for learning from errors, an essential part of the apprentice training process, such as at site 1. The challenge is to manage the balance between these two modes, professional practice, and learning, for delivery of efficient and safe care in complex critical care settings. At site 2, a unique mechanism of assigning patients to physicians is employed to ensure that the work is completed efficiently. Physicians in this ED saw one or two patients at a time and completed as much of the documentation about one patient with the help of scribers, before moving to another in a linear manner, creating much less cognitive load. This serial processing limits the need for multitasking and the prevalence of interruptions. However, there is less of a chance of an error being caught, given that

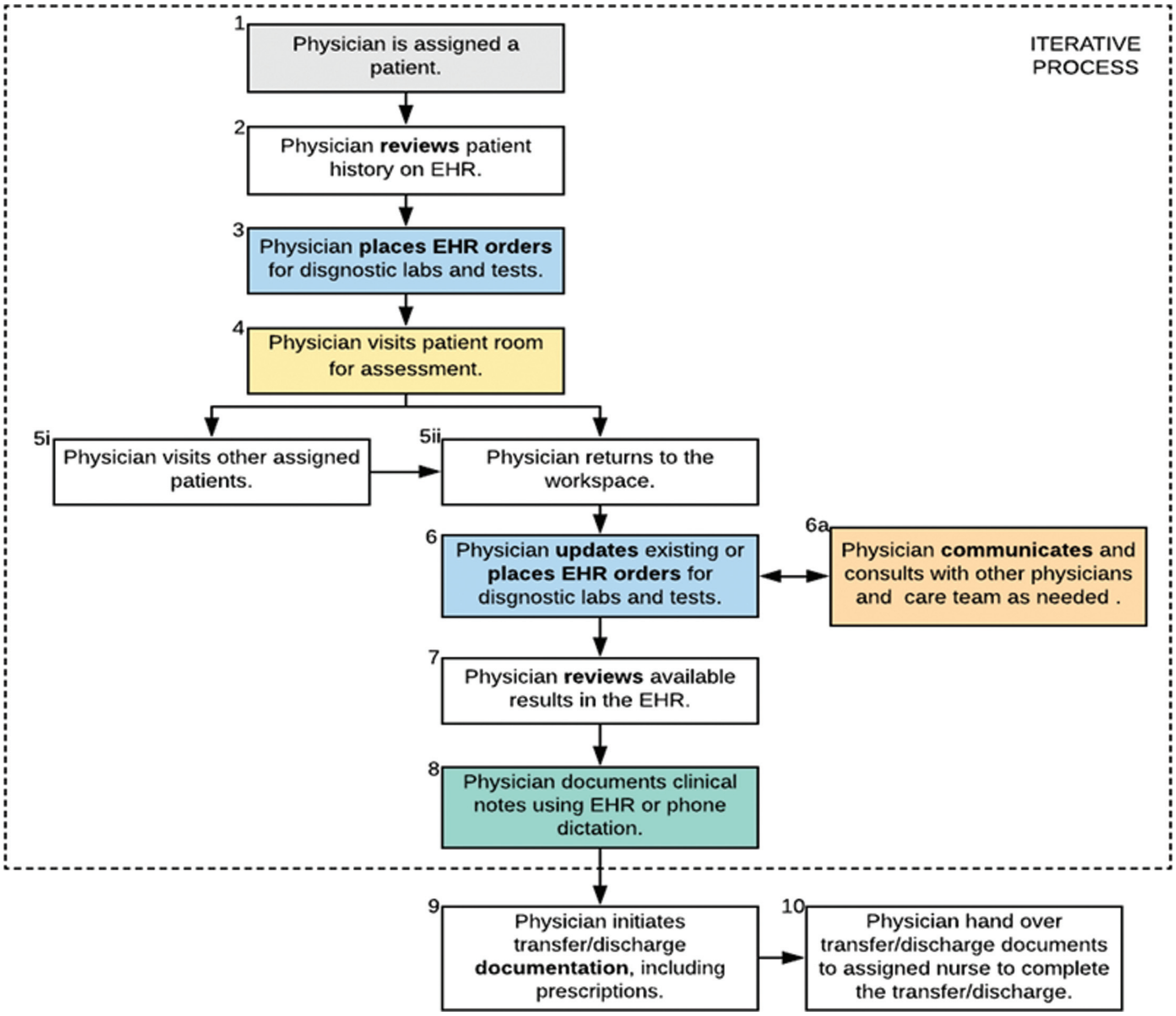

Fig. 4 Schematic site 2 physician workflow by location. Attending physician is referred to as a physician.

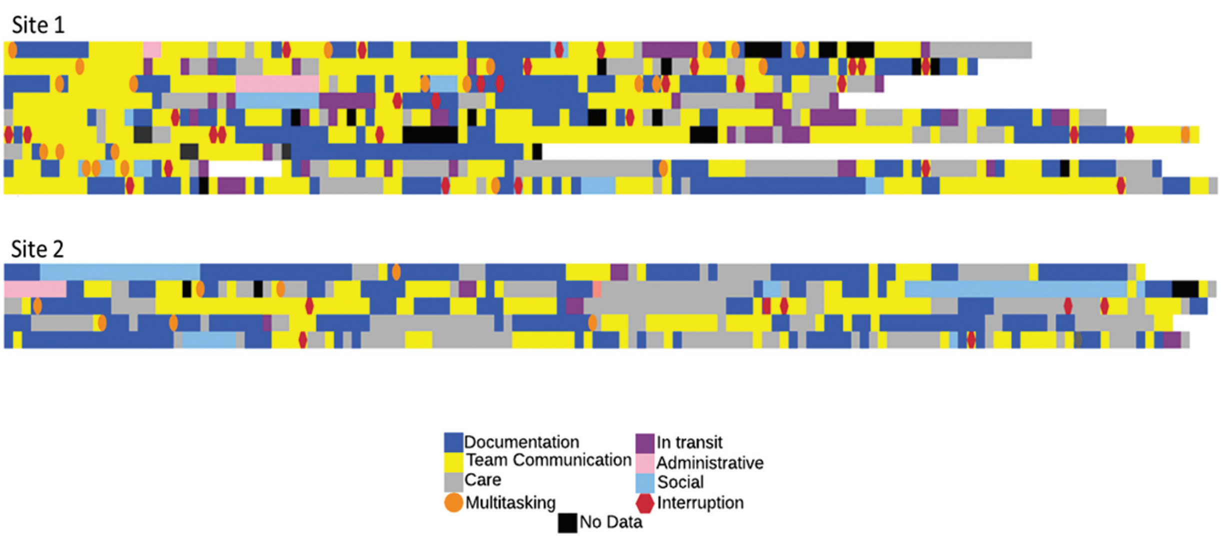

Fig. 5 Timeline belt of physician time distribution as a clinical activity at two sites for 170 minutes (average session length). The left-hand sides of the timeline belts were aligned with the starting point of the observation sessions. Each colored section's length is proportional to the amount of time spent on that task or activity.

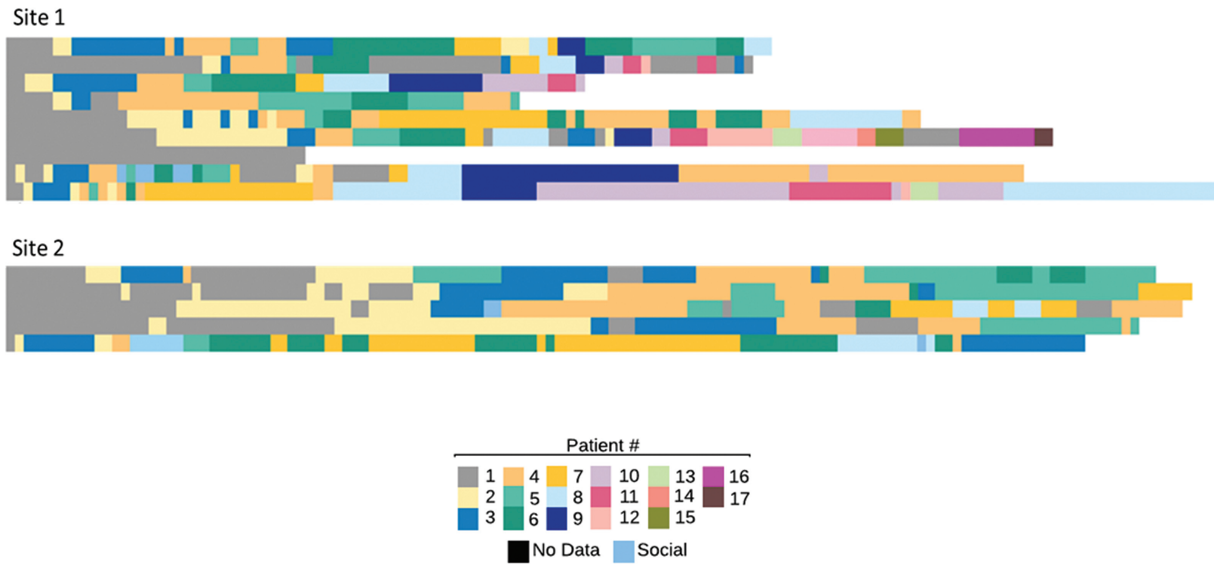

Fig. 6 Timeline belt of physician time distribution and patient care at two sites for 170 minutes (average session length). The left-hand sides of the timeline belts were aligned with the starting point of the observation sessions. Each colored section's length is proportional to the amount of time spent on that task or activity.

there was no team error check observed. Good team communication allows for resiliency and error checks, ensuring that safety is not compromised.[34]

A study of teamwork in an intensive care unit shows that teams perform better than individuals, due to advantages conferred by the distribution of cognitive task across multiple team members.[34] Data show that attending and trainee clinicians both generated errors and recover from most of them.[34] Error detection and correction in a situation closer to complex real-world clinical practice appear to induce certain urgency for quick action resulting in rapid detection and correction.[16] Furthermore, clinicians working at the bedside, as in site 2, optimize performance with little room for explicating any mistakes and thus little learning from errors.

Good teamwork is shown to be better than individuals working alone in detecting and correcting errors.[35] Error generation and recovery lead to new learning.[16] In such events, the workflow will be slow and thus inefficient, but safer, as at site 1. However, opportunities exist to enhance training so that team-based care is better understood as a cognitive collaboration, one that requires joint discussion and communication to ensure errors are recognized early.

Limitations

We investigated two clinical environments with two different EHR systems, which allowed us to describe the specific features related to each, but with limited generalizability. However, it did provide us with hypothesis-generating opportunities. We primarily observed physicians' afternoon activities, which may not be representative of mornings or the evenings. We focused primarily on the workflow patterns of physicians, although their work is also affected by other clinicians (e.g., nurses), which may provide somewhat skewed results. Although at each site we observed physicians for approximately the same length of time, more physicians were observed at site 1 than site 2, which may impact the variation in workflow patterns. Given that there was reasonable consistency in the workflow pattern of all physicians observed at site 2, the impact was less than anticipated. Finally, physicians' behavior may have changed due to being observed. This type of bias is expected in human-involved observational studies.

Conclusion

The nature of the clinical practice and EHR-mediated workflow reflects the ED work practices. Physicians in more complex organizations may be less efficient because of the fragmented workflow due to multitasking and interruptions. However, these effects can be mitigated by effort distribution through team communication, which affords inherent safety checks. A better understanding of the hidden costs of multitasking may assist ED physicians in choosing strategies that boost their efficiency.

Clinical Relevance Statement

Physicians' clinical practices in more complex EDs, with team interactions and multitasking, are slow but have more effective safety checks. Practicing in real-world situations with a high level of uncertainty and ambiguity, ED physicians learn to acknowledge complexity, thereby allowing themselves to think of alternative solutions to problems that match the complexity of any given patient condition. In this way, the physicians would embrace challenges as opportunities for adaptation as situations evolve.

Multiple Choice Questions

1. There are many specific characteristics of clinical workflow from structure of clinical tasks, coordination for

these tasks, and flow of information to support these tasks. These are often interconnected and interdependent aspects, such that any intervention in one aspect will impact the others. Which of the following is the least representative characteristic of clinical workflow?

a. Time required to complete a task
b. The number of times a same task is repeated per day
c. Location of a task
d. Sequential order in which tasks are executed

Correct Answer: Clinical workflow is a complex phenomenon that has multiple facets. Research studies focusing on one or few of these facets are bound to produce inconclusive even conflicting findings. The number of times a same task is repeated per day, however, is driven primarily by patient care needs, which is not a true characteristic of clinical workflow.

2. Qualitative studies (such as using ethnography) of clinical workflow and health IT have reported that although clinicians spend more time working at computer workstations than on patient care, these times are used in processing additional patient data and for team interactions. On the other hand, many quantitative studies assessing health IT's impact on time efficiency have generally shown no significant change in how much time they spend on patient care or working on computers. What may account for this discrepancy?

a. The institutional where these studies were conducted are different
b. Quantitative methods alone may not have captured the real impact of technology
c. Quantitative studies are more rigorous than qualitative studies
d. Participants in qualitative studies are behave differently than when reporting facts

Correct Answer: Quantitative studies assessing clinical workflow and the role of health IT's impact on time have generally focused on the proportion time that clinicians allocate to computer use versus direct patient care. This does not truly capture the impact of health IT because (1) these studies do not consider the variations in activities spent on computers (e.g., interacting with trainees and consultants) and (2) proportion time is not an accurate measure for assessing clinical workflow, because it does not capture disruptions to clinical work often associated with health IT use.

Protection of Human and Animal Subjects

The institutional review boards of New York Academy of Medicine, Icahn School of Medicine at Mount Sinai, and Mayo Clinic approved this study. Written consents were obtained from all participants.

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Conflict of Interest

None declared.

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