# Internal Medicine Resident Computer Usage: An Electronic Audit of an Inpatient Service

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In addition to direct patient contact, residents are responsible for communication, order entry, data review, and documentation. With more patient care being facilitated through computer today, there is increasing concern that little time remains for direct patient contact and education.[1] Electronic health record (EHR) audit reports can provide granular information about workflows, and are being increasingly used to investigate trainee practices.[2] Herein, we examine resident behavior on an inpatient general medicine service to describe how trainees use the EHR system as residents balance education and patient care.

## Methods

Our institution uses the EPIC EHR system. In March 2015 we retrospectively analyzed all time-stamped electronic actions logged between June 25, 2013 and June 29, 2014, by internal medicine house staff at a large academic university hospital by institutional EHR

audit. Actions corresponded to behaviors performed on the EHR, recording activities as clinicians move through various parts of the medical chart. These included, but were not limited to, reviewing medical charts, placing orders, accessing laboratory results, and generating notes. Data were extracted with our institutional informatics platform[3] and linked with residency scheduling information. Bedside computers are reserved for nursing duties while physician workstations are located in separate workrooms. This study was reviewed and approved by the Stanford Administrative Panel on Human Subjects in Medical Research.

Consecutive actions were considered part of a single computer session if they were separated by less than 5 minutes of inactivity. Because patient information is updated through EHR sign-out during transitions of care, total working time was calculated as the difference between the first and last action recorded each day. Data processing was performed with Python software, version 2.7, and R, version 2.13. *P* values for numerical and count data were calculated by 2-tailed *t* tests and Fisher exact tests, respectively, with significance thresholds of .05.

## Results

We analyzed 4 327 708 unique actions performed by 91 residents on the inpatient general medicine service. Peak activity occurred in the morning with decreases corresponding to teaching conferences (Figure). House staff worked a median (interquartile range [IQR]) of 69.2 (IQR, 56.9–79.3) hours each week; 4.2 hours (IQR, 2.9–5.5 hours) of total working time (36%) (IQR, 28.4%–43.2% of time) was spent using the EHR system per day. House staff reviewed a median of 14 patient medical charts (IQR, 10–21 charts) and had a median of 31 independent sessions (IQR, 23–38 sessions). Medical chart review accounted for most EHR activity (Table).

## Discussion

Studies performed before EHRs suggest a longstanding imbalance between indirect and face-to-face patient care.[4] However, today's EHR systems commonly feature time-saving tools that have eliminated daily transcription of vital signs, laboratory values, and medications. Using electronic audits to analyze EHR use, we show that residents continue to spend more than a third of their time on indirect patient care. Our results are consistent with those of prior efforts to quantify indirect patient care[5] and show that medical chart review accounted for most activity.

The distribution of activity is noteworthy, with morning peaks occurring when house staff have traditionally examined patients and communicated face-to-face. This supports anecdotal observations that the traditional model of gathering overnight updates at the bedside has evolved into electronic "prerounding."[1] While computer use decreased during teaching conferences, the persistent level of activity high-lights the balance between education and patient care. Of note, this study was limited to a single specialty at 1 institution without direct observation.

Responsibility for larger volumes of information, new documentation requirements, and poor user-interfaces could be contributing to increased EHR activity, highlighting opportunities to streamline workflow and directions for future study. As the role of EHRs increase, training programs should be aware of how EHRs might affect resident responsibilities and learning opportunities.

## Acknowledgments

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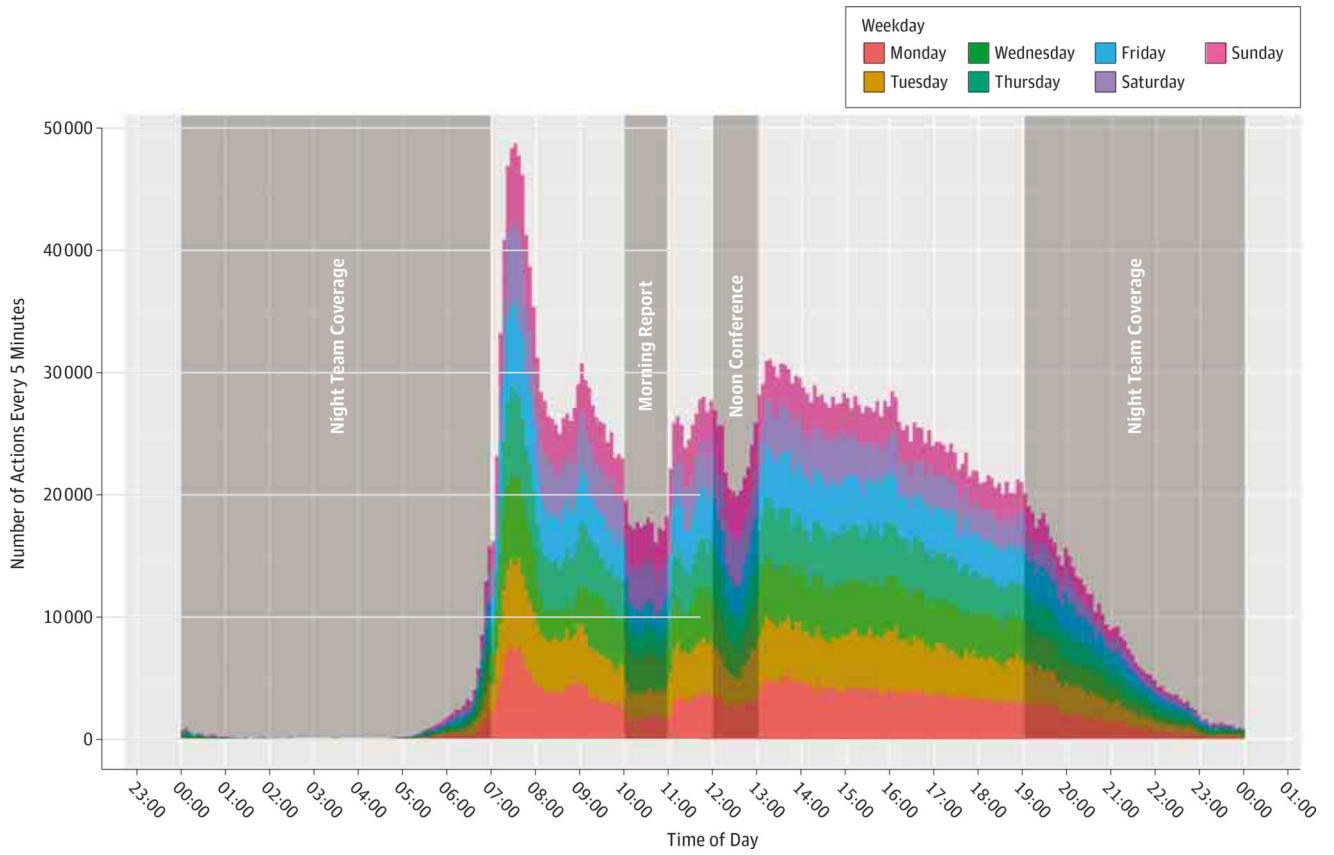
**Figure. Electronic Health Record Activity for General Medicine Inpatient Residents**
On the general medicine service, residents receive sign-out at 7 AM, morning report is scheduled for 10 to 11 AM, and the remaining morning hours are dedicated to rounds and patient care.

**Table**

Summary Statistics for General Medicine Inpatient EHR Use[a]

| Variable | PGY-1 Interns (n = 46) | PGY-2/3 Residents (n = 45) |
|---|---|---|
| Hours per week, median (IQR) | 67.2 (55.3–76.4) | 73.5 (62.2–84.2) |
| EHR of total working time, median (IQR) | 36.5 (29.2–43.7) | 34.7 (26.7–42.0) |
| Patient medical charts per day, median (IQR) | 11.9 (7.0–14.0) | 25.8 (15.0–32.0) |
| Independent sessions per day, median (IQR) | 30.5 (23.0–38.0) | 29.4 (23.0–37.0) |
| EHR action/access type, No. (%) | | |
| Medical chart review | 1 142 893 (40.8) | 699 444 (42.5) |
| Notes | 263 289 (9.4) | 116 208 (7.1) |
| Patient list review | 150 377 (5.4) | 152 791 (9.3) |
| Results review | 151 556 (5.4) | 97 069 (5.9) |
| Order entry | 99 087 (3.5) | 40 896 (2.5) |

Abbreviations: EHR, electronic health record; IQR, interquartile range; PGY, postgraduate year.

[a]$P < .001$ for all comparisons except for independent sessions per day ($P = .005$).