Time Utilization of the Electronic Health Record within General Surgery

Morgan L. Cox, MD; Alfredo Farjat, PhD; Ben Goldstein, PhD; David A. Turner, MD; John Migaly, MD

Background: The utilization of electronic health record (EHR) has become essential in the daily activities of resident and faculty physicians. EHRs are constantly used within academic medical centers as a consulting source of information, to report relevant facts, and also for displaying data in tabular or graphical form. However, the amount of time spent by physicians utilizing the EHR has not been thoroughly quantified and evaluated especially within surgical specialties.

Objectives: This study aims to analyze the EHR usage of 50 general surgery residents at Duke University during the 2016-2017 academic year. Time utilization estimates and overall global trend of the EHR by general surgery residents are reported. Additionally, the relationship between EHR time and operative case logs will be assessed.

Methods: Performance Services from Duke University retrospectively extracted de-identified login and logout time data from the Epic EHR (Verona, WI) for the 2016-2017 academic year. From these data, a binary time series was created for each resident to indicate and track over time whether he or she was utilizing the EHR system. Descriptive statistics and charts for the overall cohort usage of the EHR over time were performed. Resident demographics, post-graduate year, rotation schedules, and case logs were summarized. Categorical variables are reported as frequency counts and percentages, whereas continuous variables are summarized with means, standard deviations, and relevant quantiles. Comparisons between categorical variables were performed with Fisher exact test or Person's chi-squared test. Continuous variables groups were compared using Student t test or Wilcoxon rank sum test. Differences between multiple groups were evaluated using one-way ANOVA or Kurskal-Wallis test. The association between EHR time and the number of operative case logs was evaluated with Pearson's correlation coefficient. In all cases, the threshold for assessing statistical significance was set to level $\alpha=0.05$. Statistical analyzes were performed with R software.

Results: Fifty general surgery residents were included in the analysis, consisting of 36 clinical residents and 14 research fellows. The average ± standard deviation amount of time spent on the EHR by the residents per day of the week is 2.5 ± 1.7 hours (**Figure 1**). Residents spend significantly more time utilizing the EHR during the week compared to weekends (**Table 1**). Additionally, residents log-in more often and spend significantly more time ($p<0.0001$) in the EHR system during daytime hours compared to night hours (**Figures 2 and 3**).

Conclusions: General surgery residents spend a substantial portion of their work week utilizing the EHR. This time is concentrated during the weekdays and daytime hours, which is compatible with known clinical schedules. Further investigations will include EHR utilization by general surgery faculty and other Graduated Medical Education programs. Ultimately, as we obtain more granular data, we will correlate these quantitative results to burnout and patient outcomes prior to implementing programs to help improve efficiency and decrease the burden of charting within the EHR.

References

1) Chen L, Guo U, Illipparambil LC, et al. Racing against the clock: Internal medicine residents' time spent on electronic health records. *J Grad Med Educ.* 2016;8(1):39-44. doi: 10.4300/JGME-D-15-00240.1.
2) Gilleland M, Komis K, Chawla S, et al. Resident duty hours in the outpatient electronic health record era: inaccuracies and implications. *J Grad Med Educ*. 2014;6(1)151-4. doi: 10.4300/JGME-D-13-00061.1.
3) Oxentenko AS, Manohar CU, McCoy CP, et al. Internal medicine residents' computer use in the inpatient setting. *J Grad Med Educ*. 2012;4(4)529-32. doi: 10.4300/JGME-D-12-00026.1.
4) Butler RJ, Johnson WG. Rating the digital help: electronic medical records, software providers, and physicians. *Int J Health Econ Manag*. 2016;16(3)269-283. doi: 10.1007/s10754-016-9190-8.

Figures and Tables

Day of the Week	Mean usage time ± SD (min)
Monday	8392 ± 5229
Tuesday	8786 ± 5478
Wednesday	8239 ± 5118
Thursday	8341 ± 5267
Friday	7832 ± 5158
Saturday	5173 ± 3634
Sunday	5579 ± 3806

Table 1. Mean resident's total usage time (minutes) of the EHR by day of the week. The means across week days are not equal to each other ($p=0.0002$). There is significant difference in usage between Mon-Fri and Sat-Sun ($p<0.0001$), with lower mean usage during the weekend.

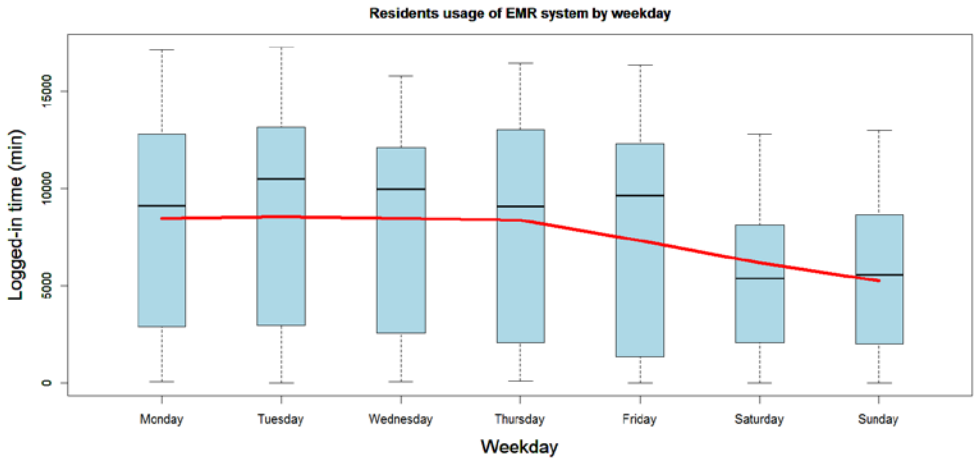

Figure 1. Boxplot of residents' total usage time (min) of the EHR system during the study period by day of the week. The overall usage mean (SD) is: 7477 (5009) minutes. The red curve was estimated using a non-parametric regression approach and indicates the overall trend.

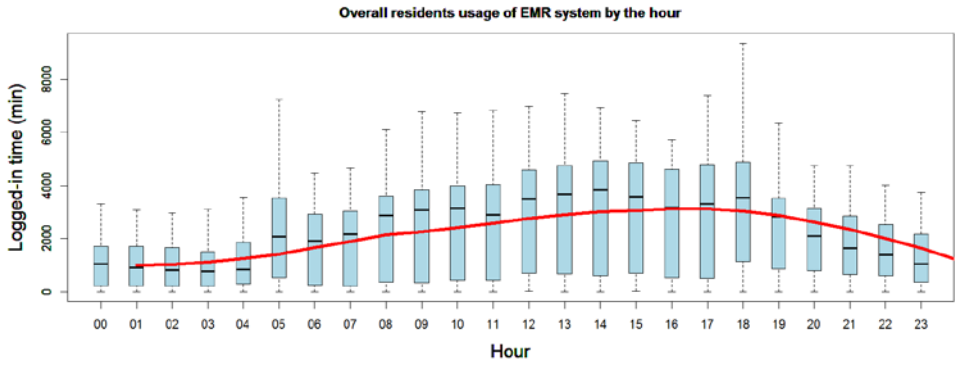

Figure 2. Boxplot of residents' total usage time (min) of the EHR system during the study period by hour of the day. The overall usage mean (SD) is: 2181 (1786) minutes. The red curve was estimated using a non-parametric regression approach and indicates the overall trend. There is a highly significant difference in logged-in time between the periods 7AM-6PM and 7PM-6AM ($p<0.0001$).

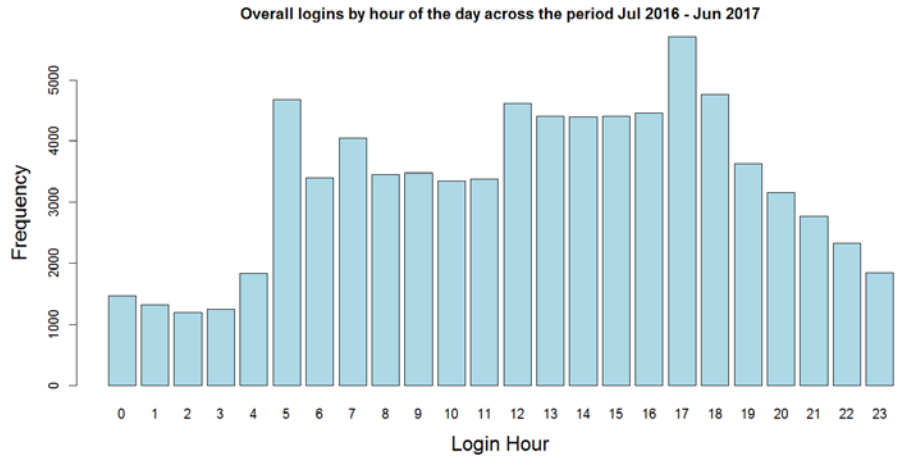

Figure 3. Frequency of logins as function of hour of the day during the study period. The overall mean (SD) number of logins is: 3307 (1297); the range of logins is: 1194 – 5713. The frequency of logins decreases during the night.