CLINICAL RESEARCH STUDY

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Electronic Health Record Use, Intensity of Hospital Care, and Patient Outcomes

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ABSTRACT

OBJECTIVE: Previous studies have suggested that weekend hospital care is inferior to weekday care and that this difference may be related to diminished care intensity. The purpose of this study was to determine whether a metric for measuring intensity of hospital care based on use of the electronic health record was associated with patient-level outcomes.

METHODS: We performed a cohort study of hospitalizations at an academic medical center. Intensity of care was defined as the hourly number of provider accessions of the electronic health record, termed "electronic health record interactions." Hospitalizations were categorized on the basis of the mean difference in electronic health record interactions between the first Friday and the first Saturday of hospitalization. We used regression models to determine the association of these categories with patient outcomes after adjusting for covariates.

RESULTS: Electronic health record interactions decreased from Friday to Saturday in 77% of the 9051 hospitalizations included in the study. Compared with hospitalizations with no change in Friday to Saturday electronic health record interactions, the relative lengths of stay for hospitalizations with a small, moderate, and large decrease in electronic health record interactions were 1.05 (95% confidence interval [CI], 1.00-1.10), 1.11 (95% CI, 1.05-1.17), and 1.25 (95% CI, 1.15-1.35), respectively. Although a large decrease in electronic health record interactions was associated with in-hospital mortality, these findings were not significant after risk adjustment (odds ratio 1.74, 95% CI, 0.93-3.25).

CONCLUSIONS: Intensity of inpatient care, measured by electronic health record interactions, significantly diminished from Friday to Saturday, and this decrease was associated with length of stay. Hospitals should consider monitoring and correcting temporal fluctuations in care intensity.

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KEYWORDS: Electronic health record; Hospital medicine

Weekend care in hospitals has been associated with poor patient outcomes.[1-7] Such temporal variations may reflect differences in the overall intensity of care delivered to patients on weekends compared with weekdays. Prior studies, using surveys and detailed chart reviews, also have demonstrated that care delays are more common on weekends.[8,9]

To measure and track the global intensity of hospital care, we recently developed a metric based on use of the hospital electronic health record.[10] We considered each opening of a patient record to represent an instance of individual patient care. Counting these accessions of the medical record, which we termed "electronic health record interactions," was found to be a sensitive measure of temporal variations in care. At the level of the hospital, we observed a reduction in care intensity by two thirds on weekends compared with weekdays.[10] To our knowledge, electronic health record interactions represent the first measure of global intensity of care in the contemporary hospital.

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The purpose of the present study was to determine whether there is an association between electronic health record interactions and patient-level outcomes. We hypothesized that fewer electronic health record interactions on weekends would be associated with reduced progression in care as measured by increased length of stay and lower likelihood of weekend discharge. We further hypothesized that electronic health record interactions would be correlated with clinical outcomes, including mortality.

CLINICAL SIGNIFICANCE

- Intensity of care, as measured by electronic health record interactions, decreased for three fourths of hospitalized patients.
- A decrease in electronic health record interactions on weekends was associated with increased length of stay in a dose-dependent manner.
- Electronic health record interactions were not associated with readmissions or mortality after adjusting for covariates.

MATERIALS AND METHODS

We performed a retrospective cohort study of patients hospitalized at New York University Langone Medical Center, an urban academic institution, between January 1, 2011 and September 30, 2012, using data derived from the hospital electronic health record. Hospitalizations were included if the length of stay was greater than 48 hours and encompassed at least 1 consecutive complete Friday and Saturday. We excluded patients aged less than 18 years and those hospitalized to the obstetrical service. Only the first hospitalization was included for patients with more than 1 hospitalization during the study period.

As previously described, we tracked the global intensity of care delivered during each hospitalization using a measure termed "electronic health record interactions," calculated as the mean hourly number of electronic health record accessions per patient by a clinical provider (eg, physician, nurse, resident physician, pharmacist, physical therapist).[10] During the study period, the majority of inpatient clinical activities were performed and documented through New York University Langone Medical Center's electronic health record, Sunrise Clinical Manager (Allscripts, Chicago, Ill). These activities included clinical documentation, orders, medication administration, and results of diagnostic tests.[10]

We measured weekday to weekend change in intensity of care by determining the difference in mean hourly electronic health record interactions between the first Friday and the first Saturday of each hospitalization. Differences between Friday and Saturday electronic health record interactions were categorized as ≥ 0.5, 0.4 to -0.4, -0.5 to -1.4, -1.5 to -2.4, and ≤ -2.5; we termed these categories increase, no change, small decrease, moderate decrease, and large decrease, respectively. We based this choice of magnitude ranges on the previously measured mean hourly number of electronic health record interactions at our institution.[10] "No change" was used as our reference category for statistical analysis.

For this study, we defined length of stay, termed "study length of stay," as the number of days from the Saturday of

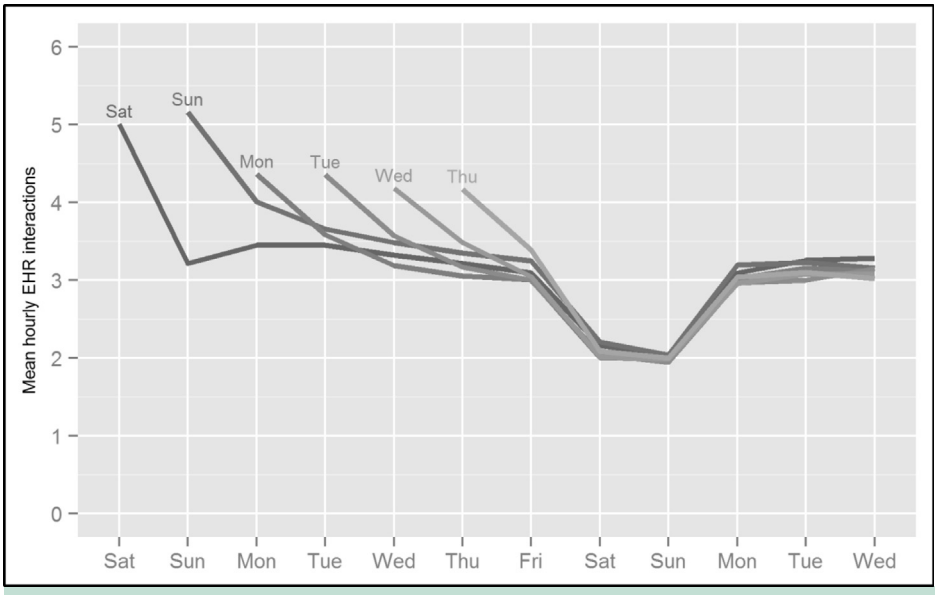

Figure 1 Mean hourly number of electronic health record interactions per patient per day of the week, by weekday of admission. Lines represent weekday of admission. EHR = electronic health record.