



Patient Outcomes when Housestaff Exceed 80 Hours per Week

David Ouyang, MD,^a Jonathan H. Chen, MD, PhD,^b Gomathi Krishnan, PhD,^c Jason Hom, MD,^a Ronald Witteles, MD,^a Jeffrey Chi, MD^a

^aDepartment of Internal Medicine, Stanford University School of Medicine, Calif; ^bCenter for Innovation to Implementation, Veterans Affairs Palo Alto Health Care System, Calif; ^cStanford Center for Clinical Informatics, Stanford University School of Medicine, Calif.

ABSTRACT

BACKGROUND: It has been posited that high workload and long work hours for trainees could affect the quality and efficiency of patient care. Duty hour restrictions seek to balance patient care and resident education by limiting resident work hours. Through a retrospective cohort study, we investigated whether patient care on an inpatient general medicine service at a large academic medical center is impacted when housestaff work more than 80 hours per week.

METHODS: We identified all admissions to a housestaff-run general medicine service between June 25, 2013 and June 29, 2014. Each hospitalization was classified by whether the patient was admitted by housestaff who have worked more than 80 hours per week during their hospitalization. Housestaff computer activity and duty hours were calculated by institutional electronic health record audit, as well as length of stay and a composite of in-hospital mortality, intensive care unit (ICU) transfer rate, and 30-day readmission rate.

RESULTS: We identified 4767 hospitalizations by 3450 unique patients; of which 40.9% of hospitalizations were managed by housestaff who worked more than 80 hours that week during their hospitalization. There was a significantly higher rate of the composite outcome (19.2% vs 16.7%, $P = .031$) for patients admitted by housestaff working more than 80 hours per week during their hospitalization. We found a statistically significant higher length of stay (5.12 vs 4.66 days, $P = .048$) and rate of ICU transfer (3.53% vs 2.38%, $P = .029$). There was no statistically significant difference in 30-day readmission rate (13.7% vs 12.8%, $P = .395$) or in-hospital mortality rate (3.18% vs 2.42%, $P = .115$). There was no correlation with team census on admission and patient outcomes.

CONCLUSIONS: Patients taken care of by housestaff working more than 80 hours per week had increased length of stay and number of ICU transfers. There was no association between resident work-hours and patient in-hospital mortality or 30-day readmission rate.

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Over the last 13 years, the Accreditation Council for Graduate Medical Education (ACGME) has placed limitations on resident work hours. These regulations were

intended to limit resident sleep loss and fatigue, with a goal of minimizing errors in patient care and improving high-yield education.¹⁻⁴ Such changes were not without

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Authorship: DO, JHC, and JC had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Requests for reprints should be addressed to Jeffrey Chi, MD, Stanford University School of Medicine, Department of Internal Medicine, Stanford, CA 94305.

E-mail address: jeffrey.chi@stanford.edu

controversy: concerns have subsequently been raised about the adoption of “shift mentality,” decreased experience in patient care, and inexperience in handoffs leading to errors in patient care.¹ Additionally, changes in resident work-structure have the potential to cause unforeseen consequences, including an increased number of patient care handoffs and increased attending physician workloads.²

Notably, duty hour standards were adopted without high-quality evidence suggesting benefit to patient care or safety.³⁻⁶ Large studies using national patient samples immediately after the institution of ACGME resident duty hour limits failed to show significant change in the quality or safety of inpatient care,⁷⁻⁹ though these studies did not directly track resident work hours. Rather, these studies primarily examined differences in patient outcomes based on changes in resident team structures and schedules implemented to adhere to ACGME duty hour standards. A recent study at an internal medicine program also did not show any increase in adverse events with discontinuity of care.¹⁰ Large randomized studies of surgical training programs have not shown any significant difference in patient care or trainee well-being, and a similar trial involving internal medicine programs is still underway.^{11,12} Although we are now more than a decade out from the implementation of duty hour standards, these requirements and their implications remain controversial and insufficiently studied.

One important limitation of monitoring and studying of resident duty hours has been a reliance on self-reported data, which can be prone to individual manipulation or recall bias, and residents are implicitly incentivized to avoid duty hour violations. When compared against independent, objective data, self-reported duty hours are often inconsistent and can underestimate duty hour violations.¹³⁻¹⁵ In the present study, we sought to determine the association between resident duty hours and the quality of patient care by directly correlating resident work hours, as determined by electronic health record usage, with the clinical outcomes of the patients they manage.

METHODS

Study Design and Setting

We conducted a retrospective cohort study of all patients admitted to the inpatient general medicine service of a large academic medical center in Stanford, California between June 25, 2013 and June 29, 2014.¹⁶ The general medicine service is the largest service at this academic teaching

hospital, with 5 teams each comprising 2 interns, 1 senior resident, and an attending physician. Teams rotate on a 5-day call cycle, admitting new patients from 7 AM to 7 PM on the first and fourth days of the schedule. Patients were matched to housestaff by team assignment and classified by whether either the intern or supervising resident

worked more than 80 hours during the week of admission. Patients who were initially admitted to the intensive care service then subsequently transferred to medicine were excluded from this analysis. This study was approved by the Stanford University Institutional Review Board. The first 2 authors and the last author vouch for the validity of the data and analyses.

Resident Duty Hour Analysis and Data Source

Residents on the general medicine service were identified by residency program scheduling information, and electronic actions performed were extracted by institutional electronic health record audit. Our institution uses the EPIC Electronic Health Record system, and data were extracted with support from our institutional informatics platform.¹⁷ Actions identified include, but were not limited to, viewing laboratory results, placing orders, performing medication reconciliation, and generating notes in the electronic health record. Total working time was calculated as the time difference between the first and last action recorded each day. The entire analysis was also repeated while excluding the first and last 5% of electronic actions each day to minimize the influence of outliers in resident behavior. Hours worked per week were calculated as the summation of daily working time for each calendar week from Sunday to Saturday. Activity from the night float team was excluded from the analysis. Team census was determined by identifying the number of unique patients taken care of by each inpatient medical team. Patient length of stay, mortality, transfer to the intensive care unit (ICU), and 30-day same-hospital readmission status were also obtained from the electronic health record.

Outcome Measures

The primary outcome was a composite of death, transfer from medicine team to the ICU, or 30-day same-hospital readmission, because these metrics reflect a complicated hospital course. Secondary outcomes included patient length of stay, in-hospital mortality, transfer to the ICU, and readmission within 30 days. Death and length of stay were directly ascertained from the dataset. Hospital admission times and discharge times were used to identify 30-day same-hospital readmissions. Intensive care unit transfers

CLINICAL SIGNIFICANCE

- Increases in patient length of stay and transfers to the ICU are associated with housestaff working in excess of 80 hours per week.
- No significant increase in patient mortality or readmission rates occur when housestaff exceed 80 hours per week.
- Under current ACGME guidelines, increases in resident team census have no significant effect on length of stay, mortality, readmissions, or ICU transfers.

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