

Resident Duty Hours in the Outpatient Electronic Health Record Era: Inaccuracies and Implications

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Abstract

Background The Accreditation Council for Graduate Medical Education expects resident duty hours to be monitored, yet no previous studies have examined the effect of after-hours electronic health record (EHR) use on resident hours or burnout.

Objective We assessed internal medicine residents' perceived and actual time spent on after-hours outpatient EHR use and calculated increased duty hours if after-hours EHR use were included; we also assessed its effect on resident burnout.

Methods We retrospectively aggregated time spent logged on to the outpatient EHR for residents in a general internal medicine clinic for 13 weeks in 2011. Residents completed a survey on EHR use, which was correlated with objectively recorded data on EHR usage. We compared actual and self-reported EHR time and

identified violations that would be generated if these hours were included in reported duty hours. We also correlated resident after-hours EHR use with responses to an internally developed burnout survey.

Results The 44 residents in this study overestimated time spent on the ambulatory EHR (they spent 3.03 hours/week on after-hours use compared with a recorded 1.20 hours/week). In total, 190 duty hour violations (mean duration of violation = 37 minutes) would have been generated if after-hours EHR usage were included in residents' reported duty hours.

Conclusions Resident estimates of EHR use by residents were not accurate; including after-hours EHR use would increase the number of reported duty hour violations. There was no association between after-hours EHR use and resident burnout.

Editor's Note: The online version of this article contains the fatigue/burnout survey used in the study.

Introduction

With the introduction of the electronic health record (EHR), physicians are spending a substantial amount of time in electronic documentation.^{1–3} Remote availability of the EHR means practicing physicians and trainees may complete chart documentation outside of work and after usual

working hours. The Accreditation Council for Graduate Medical Education (ACGME) expects residency program directors to monitor their work hours, including the time residents spend documenting patient care after hours.⁴ Most programs rely on resident self-reports to capture all hours residents spend on direct and indirect patient care.

Several studies have evaluated the accuracy of self-reported duty hours, producing conflicting results. Internal medicine residents rotating in an intensive care unit accurately self-reported inpatient EHR use compared with objective data,⁵ and another study found no significant difference between time-stamped parking data and self-reported work hours for residents.⁶ In contrast, a study from 2002 showed little consistency between daily and monthly duty hour reports.⁷ Other studies have focused on how duty hour regulations affect resident stress levels, finding decreased burnout (emotional exhaustion, depersonalization, and depression) after implementation of the 2003 duty hour standards.^{8,9} To date, no studies have systematically assessed after-hours use of the EHR by residents, nor have any included off-site EHR time in duty hour calculations. Finally, data correlating resident burnout with after-hours EHR use are limited.

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TABLE 1 SURVEY RESPONSE: HOW FREQUENTLY DO YOU LOG ON TO CENTRICITY (ELECTRONIC HEALTH RECORD) AFTER HOURS?			
Response	Attendings	Residents	Total
1 to 2 days per week	1 (7% of attending responses)	15 (42% of resident responses)	16 (31% of combined responses)
3 to 5 days per week	4 (27%)	14 (39%)	18 (35%)
A few days per month	0 (0%)	3 (8.3%)	3 (5.9%)
Daily/almost daily	10 (67%)	4 (11%)	14 (27%)
Total	15	36	51 (100%)

We hypothesized that internal medicine residents do not accurately estimate their use of an outpatient EHR; accurate recording of EHR use would increase duty hour violations. Additionally, we hypothesized that after-hours use of the EHR by residents does not increase resident burnout.

Methods

The Centricity EHR is used for outpatient care documentation by internal medicine faculty and residents at Georgetown University Hospital, a large university hospital. Physicians log on individually, and the system automatically logs off after a brief period of inactivity. All logons and logoffs are tracked on a server. We retrospectively collected logon and logoff times for continuity clinic residents and attending physicians (for comparison) and compiled cumulative time on the EHR for the period from September 15, 2011 to December 15, 2011. For each resident, we summed the total amount of time logged on after hours (defined as any EHR use that occurred outside of their electronically logged duty hours). We compared duty hours residents reported with the time they were logged on to the EHR system and identified when after-hours logons would trigger a duty hour violation. We also asked attendings to estimate their weekly after-hours EHR use. In addition, we collected results from an internally developed 5-point burnout survey that residents are required to complete monthly (provided as online supplemental material).

Kappa and weighted kappa agreements for 2 raters were used to determine the correlation between actual time

spent on Centricity and the self-report of the perceived amount of time spent on Centricity. Spearman correlations were used to determine how after-hours EHR use and duty hours logged correlated with level of burnout.

This study was approved by the Georgetown University Institutional Review Board.

Results

Data were collected for 44 residents (18 in postgraduate year [PGY]-1, 12 in PGY-2, and 14 in PGY-3), representing approximately half of the program’s internal medicine residents, and 15 attending physicians. Residents spent an average of 4 hours per week on the EHR system and logged an average of 1.2 hours per week after hours. After-hours use represented 27% of total EHR use.

Residents significantly overestimated the amount of time spent on after-hours EHR use (3.03 ± 1.83 hours per week estimated versus 1.20 ± 0.95 actual hours; $P < .001$). Attendings also overestimated after-hours EHR use: 7.4 hours per week estimated versus 3.36 hours per week actual time (TABLE 1). Average objective faculty time spent on after-hours EHR use is nearly 3 times that of the residents. Comparing residents’ actual time to self-reported time spent on after-hours EHR use revealed a weighted kappa of 0.2 ($P = .01$) for weekly times logged on, and a weighted kappa of 0.1475 ($P = .06$) for weekly after-hours EHR time.

Adding objectively logged after-hours EHR use to resident self-reported duty hour logs generated 190 duty hour violations across the 44 residents in the study; an

TABLE 2 RESIDENTS SELF-REPORTED DUTY HOURS				
Variable	Mean	SD	Minimum	Maximum
Number of duty hours reported per week	53.31	8.72	20.09	69.24
EHR use after self-reported duty hours (hours/week)	0.994	0.921	0.023	5.151
EHR use after self-reported duty hours (count/week)	1.439	0.879	0.228	4.641

Abbreviation: EHR, electronic health record.

TABLE 3 SPEARMAN CORRELATIONS WITH RESULTS FROM RESIDENT BURNOUT SURVEY (N = 139)

Variable	R	P Value
Total time logged on EHR (hours/week)	−0.04357	.61
Average number of logons after 5 PM per week	−0.25957	.002
Average number of hours spent in EHR after 5 PM per week	−0.11691	.17
Average number of hours spent in EHR after 5 PM per week/total time logged on	0.20453	.02

Abbreviation: EHR, electronic health record.

average of 1.44 new violations per resident per month. The most common violation triggered after adding EHR time, occurring 145 times during the study period, was noncompliance with the 10-hour standard (failure to have 10 hours off between shifts). There were also 21 violations of the standard that interns may not work longer than 16 consecutive hours, 18 violations of the rule that requires residents to have 14 hours off after a 28-hour shift, and 6 instances of noncompliance with the standard requiring 1 day per week to be free from all program duties (averaged over the 13 weeks). There were no violations in the 80-hour weekly limit as a result of after-hours EHR use. Nearly half (47%) of the violations identified in our calculation were greater than 30 minutes; the average duration of violation time was 37 minutes per occurrence (range = 1 to 598 minutes).

TABLE 2 shows EHR use after self-reported duty hours.

Spearman correlations with burnout (TABLE 3) showed an inverse relationship between total hours of EHR use, number of after-hours logons to the EHR, and after-hours time spent on the EHR with resident burnout.

Discussion

The major findings of this study support our hypotheses that residents would not accurately estimate the amount of after-hours time they spend on EHR use. If the actual time spent on the outpatient EHR were added to resident's self-reported duty hours, duty hour violations would increase. However, residents did not report a higher level of burnout with increasing amounts of outpatient EHR usage.

Prior research has found self-reported duty hours to be accurate when comparing self-reported data to actual time spent in the hospital.^{5,6,10} The outpatient setting of our study may account in part for the inaccuracy of self-reported EHR use.

There is concern that residents may minimize self-reported duty hours to avoid noncompliance with ACGME standards. We attempted to control for these inaccuracies by asking residents to estimate their after-hours use of the EHR and found that resident self-reports overestimated their EHR use.

Our results are consistent with earlier studies that found that objective tracking of data identifies noncompliance with the ACGME duty hour standards.¹¹ Although the total time residents spent on the EHR after hours was small (approximately 1 hour per week), half of the instances of noncompliance identified by our study were greater than 30 minutes.

Measuring the level of resident burnout has been used previously to track the effects of duty hour restrictions, and studies have shown decreased levels of burnout after duty hour reductions.^{8,9} We did not find a correlation with burnout and the amount of time spent on the EHR after hours.

There are several limitations in our study. The study had a small sample size and was performed at a single institution, limiting generalizability. Although the EHR system automatically logs users off after a period of inactivity, duty hour violation calculated from EHR logs may not be accurate as residents may have been engaging in other, non-work-related activities during the time they were logged on. Our study also assumed that resident self-reported logged duty hours accurately reflect their actual hours. Our EHR usage and burnout surveys were created internally.

Conclusion

Residents at a large university internal medicine clinic were not able to accurately estimate the time spent using an outpatient EHR, resulting in added instances of duty hour noncompliance. However, there was no evidence that after-hours EHR use increases negative outcomes, such as burnout. Because the primary purpose of regulating duty hours is to reduce fatigue and burnout that could lead to medical errors, the utility of requiring programs to report after-hours EHR use is questionable.

References

- Hripcsak G, Vawdrey DK, Fred MR, Bostwick SB. Use of electronic clinical documentation: time spent and team interactions. *J Am Med Inform Assoc*. 2011;18(2):112–117.
- Pizziferri L, Kittler AF, Volk LA, Honour MM, Gupta S, Wang S, et al. Primary care physician time utilization before and after implementation of an electronic health record: a time-motion study. *J Biomed Inform*. 2005;38(3):176–188.

- 3 Murphy DR, Reis B, Sittig DF, Singh H. Notifications received by primary care practitioners in electronic health records: a taxonomy and time analysis. *Am J Med.* 2012;125(2):209.e1–e7.
- 4 Accreditation Council for Graduate Medical Education. Frequently Asked Questions—ACGME Common Duty Hour Requirements. VI.G.1: Maximum Hours of Work Per Week. Updated September 1, 2011. <http://www.acgme.org/acgmeweb/Portals/o/PDFs/dh-faqs2011.pdf>. Accessed October 25, 2013.
- 5 Shine D, Pearlman E, Watkins B. Measuring resident hours by tracking interactions with the computerized record. *Am J Med.* 2010;123(3):286–290.
- 6 Chadaga SR, Keniston A, Casey D, Albert RK. Correlation between self-reported resident duty hours and time-stamped parking data. *J Grad Med Educ.* 2012;4(2):254–256.
- 7 Saunders DL, Kehoe KC, Rinehart VH, Berg BW. Self-reporting of internal medicine house staff work hours. *Hawaii Med J.* 2005;64(1):14–16.
- 8 Landrigan CP, Fahrenkopf AM, Lewin D, Sharek PJ, Barger LK, Eisner M, et al. Effects of the Accreditation Council for Graduate Medical Education duty hour limits on sleep, work hours, and safety. *Pediatrics.* 2008;122(2):250–258.
- 9 Gopal R, Glasheen JJ, Miyoshi TJ, Prochazka AV. Burnout and internal medicine resident work-hour restrictions. *Arch Intern Med.* 2005;165(22):2595–2600.
- 10 Todd SR, Fahy BN, Paukert JL, Mersinger D, Johnson ML, Bass BL. How accurate are self-reported resident duty hours? *J Surg Educ.* 2010;67(2):103–107.
- 11 Chang LW, Vidyarthi AR, Kohlwes RJ. Baseline duty hours recorded with time-cards: a pre-regulation study of internal medicine residents. *Med Educ.* 2006;40(7):662–666.