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Associations of physician burnout with organizational electronic health record support and after-hours charting

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ABSTRACT

In 2017, 43.9% of US physicians reported symptoms of burnout. Poor electronic health record (EHR) usability and time-consuming data entry contribute to burnout. However, less is known about how modifiable dimensions of EHR use relate to burnout and how these associations vary by medical specialty. Using the KLAS Arch Collaborative’s large-scale nationwide physician (MD/DO) data, we used ordinal logistic regression to analyze associations between self-reported burnout and after-hours charting and organizational EHR support. We examined how these relationships differ by medical specialty, adjusting for confounders. Physicians reporting ≤ 5 hours weekly of after-hours charting were twice as likely to report lower burnout scores compared to those charting > 6 hours. (aOR: 2.43, 95% CI: 2.30, 2.57). Physicians who agree that their organization has done a great job with EHR implementation, training, and support (aOR: 2.14, 95% CI: 2.01, 2.28) were also twice as likely to report lower scores on the burnout survey question compared to those who disagree. Efforts to reduce after-hours charting and increase organizational EHR support could help address physician burnout.

INTRODUCTION

Burnout, a syndrome of emotional exhaustion, depersonalization, and a low sense of personal accomplishment, is a common problem among US physicians.1 The prevalence of US physician burnout was 43.9% in 2017, which was higher than among other working adults.2–4 Physician burnout is recognized as a significant problem with associated morbidity and mortality, including poor clinical care, medical mistakes, physicians leaving medicine, and suicide.5,6 The US economic burden of turnover and reduced clinical hours attributable to physician burnout is estimated to be $4.6 billion each year.7

A national report quantified top contributors to burnout based on the frequency with which each answer choice was selected. Too many bureaucratic tasks (55%) and the increasing computerization of practice (30%) were among the top responses.3 Specifically, evidence suggests that poor electronic health record (EHR) usability, high volume of patient call messages, and time-consuming data entry contribute to professional dissatisfaction.8–11 The amount of time spent on EHRs doing nonclinical work and documentation outside regular clinic hours are also associated with physician burnout.12–16

Existing literature examining the associations between burnout and the EHR is limited to specific medical specialties or select healthcare organizations. The narrow scope of these studies limits their generalizability and precludes the possibility of examining the impact of individual organizations. The effect of EHRs on
physicians could vary depending on how the EHR is implemented and supported within an organization, but there is little data to support this idea.

Using KLAS Arch Collaborative survey responses from 25,018 physicians (MD/DO) at 213 organizations throughout the United States, we aimed to quantify the extent to which EHR satisfaction factors, namely after-hours charting and organizational EHR support, are associated with self-reported burnout overall and by physician specialty. Better understanding these measures will allow healthcare organizations to more effectively focus efforts to mitigate physician burnout.

**MATERIALS AND METHODS**

KLAS, an independent health information technology firm, began the Arch Collaborative in 2017 to measure and establish a benchmark for the clinician EHR experience. KLAS partnered with health systems to pilot research surveys. Since then, more than 200 separate health organizations (comprised primarily of community health systems, large health systems, and academic health systems) have participated in the Arch Collaborative, and most areas of medical practice are represented. The Collaborative’s main data-collection instrument is a web-based survey that is available for public use. Additional benchmarking data are available to organizations with a paid subscription to the Arch Collaborative. The core survey contains 35 questions. Participating organizations can make minor edits for clarity, add additional questions, or exclude irrelevant or sensitive questions. The survey is distributed to clinicians by healthcare organization leadership. The Arch Collaborative collects and analyzes the data and generates a report that includes national benchmarking. The database includes responses from over 46,000 physicians. A single-question burnout measure was added to the survey in 2018, and more than 25,000 burnout responses from over 200 healthcare organizations have been collected through June 2020.

**Measures**

The dependent variable of this study is represented by the single-question taken from the AMA mini-Z measurement for burnout. “Using your own definition of burnout, select 1 of the answers below: 1. I enjoy my work, I have no symptoms of burnout. 2. I am under stress and don’t always have as much energy as I did, but I don’t feel burned out. 3. I am definitely burning out and have 1 or more symptoms of burnout (eg, emotional exhaustion). 4. The symptoms of burnout that I am experiencing won’t go away. I think about work frustrations a lot. 5. I feel completely burned out. I am at the point where I may need to seek help.” Similar self-reported single questions have been validated and used in studies as a representation of burnout, though this single measure likely underrepresents burnout. We combined responses from options 3, 4, and 5 to calculate the percentage of physicians burned out for each specialty.

The focus of the Arch survey is to measure the EHR end-user experience. Accordingly, several questions are used to measure aspects of the EHR experience. Preliminary analyses indicated that 1 of our main independent variables, organizational EHR support, was among the survey measures most highly correlated with burnout. Other similar variables were excluded from our analysis due to colinearity. The Arch survey assesses the provider’s impression of organizational support of their use of the EHR with the prompt: “Our organization has done a great job of implementing, training on, and supporting the EHR.” The respondents could then answer on a 5-point Likert scale from strongly disagree to strongly agree. Consequently, rather than assessing each individual component, this question collectively assesses EHR implementation, training, and support.

Our other main independent variable is after-hours charting. Prior research has highlighted the effect that after-hours work has on burnout among much smaller populations than in the current study. The Arch Collaborative measures after-hours charting with the following question: “How many hours per week do you spend completing your charting outside of your normal business hours (evenings, weekends, after your shift, etc.)?” Respondents then selected banded answers under the following ranges: 0–5 hours, 6–15 hours, 16–25 hours, and 25+ hours. The likelihood of experiencing symptoms of burnout became more common with each increase in time spent on after-hours charting (see Table 1), with the largest jump occurring between 0–5 hours and 6–15 hours.

Confounding variables (see Table 1) were also taken from the Arch Collaborative survey, including healthcare organization, geographic region (taken from the longitude and latitude using the respondent’s IP address and converted into census regions), the EHR vendor used, years of practicing medicine, and years using the EHR (0–4 years and 5+ years). Physicians with missing responses for any of the included variables were excluded from the study.

**Analyses**

Ordinal logistic regression was used to analyze the association between burnout and after-hours charting and organizational EHR support. Individual burnout was measured on an ordinal scale from completely burned out to no burnout. Organizational EHR support was measured using the question: “Do you agree with the following statement? Our organization has done a great job of implementing, training on, and supporting the EHR.” Responses ranging from “strongly disagree” to “neither agree nor disagree” were coded as “disagree.” Responses ranging from “agree” to “strongly agree” were coded as “agree.” For after-hours charting, physicians were grouped by those who reported 0–5 hours of after-hours charting per week and those who reported 6+ hours of charting.

The final model included burnout on a 5-point Likert scale as the main outcome variable with the dichotomized variables for after-hours charting and organizational EHR support as the main explanatory variables, and controlling for organization using clustering, census region, EHR vendor, years practicing medicine, and years using the EHR. The physician specialty model replicated the original model but was limited to specialties with 300 or more respondents. Each specialty was mutually exclusive, meaning they were only able to select 1 self-identified specialty.

**RESULTS**

The demographic characteristics of the study population are presented in Table 1. Of the 25,018 respondents, 33.6% were from academic health systems, followed by 28.6% from large health systems (those with over 1500 beds). About 29% of respondents were in the Midwest and 28% in the South. Over 68% of respondents use Epic as their primary EHR vendor, followed by Cerner (15.8%). About 33% of participating physicians had been practicing medicine for 25+ years at the time of the survey. Almost 52% had been using the EHR for at least 5 years when surveyed.
Table 2 presents descriptive data for burnout, after-hours charting, and organizational EHR support. The level of burnout in our study ranged from 22% to 34% by specialty. The specialties with the highest levels of burnout in our study were family medicine (34%) and hematology/oncology (33%). The specialties with the lowest levels of burnout were psychiatry (22%) and anesthesiology (24%).

The associations between physician burnout and after-hours charting are presented in Figure 1. After adjusting for confounding variables, physicians with 5 or fewer hours of weekly after-hours charting (aOR: 2.43, 95% CI: 2.30, 2.57) were twice as likely to report lower levels of burnout than those with 6 or more hours. Figure 2 presents the associations between physician burnout and organizational EHR support. Those who agree that their organization has done a great job with EHR implementation, training, and support (aOR: 2.14, 95% CI: 2.01, 2.28) were also twice as likely to report lower levels of burnout than those who disagreed.

Table 1. Demographic variables

| Demographic Variables | Organizations n = 213 | Organization % | Respondents n = 25,018 | Respondent % |
|-----------------------|-----------------------|----------------|------------------------|--------------|
| Organization Type     | Community Health System 45 | 21.00% | 3267 | 13.00% |
|                       | Large Health System 44 | 20.60% | 7180 | 28.60% |
|                       | Academic Health System 40 | 18.70% | 8941 | 35.60% |
|                       | Community Hospital 29 | 13.60% | 695 | 2.80% |
|                       | Midsize Health System 22 | 10.30% | 2592 | 10.30% |
|                       | Children’s Hospital 17 | 7.90% | 1324 | 5.30% |
|                       | Ambulatory Care Group 19 | 8.90% | 1132 | 4.50% |
| Geographic Regiona    | West 100 | 47% | 4460 | 18% |
|                       | Midwest 94 | 44% | 7135 | 29% |
|                       | Northeast 88 | 41% | 6543 | 26% |
|                       | South 113 | 53% | 6880 | 28% |
| EHR Vendorb           | Epic 148 | 69.20% | 17,204 | 68.50% |
|                       | Other 81 | 37.90% | 1060 | 4.20% |
|                       | Cerner 43 | 20.10% | 3976 | 15.80% |
|                       | MEDITech 32 | 15.00% | 525 | 2.10% |
|                       | Allscripts 23 | 10.70% | 1038 | 4.30% |
|                       | eClinicalWorks 22 | 10.30% | 1075 | 4.30% |
|                       | NextGen Healthcare 11 | 5.10% | 39 | 0.20% |
| Years Practicing Medicine | 0–4 years 1343 | 5.30% | 4460 | 18% |
|                       | 5–14 years 7789 | 31.00% | 1060 | 4.20% |
|                       | 15–24 years 7196 | 28.60% | 3976 | 15.80% |
|                       | 25+ years 8315 | 33.10% | 525 | 2.10% |
| Years Using the EHR   | 1 year 2274 | 9.00% | 1038 | 4.30% |
|                       | 2 years 1818 | 7.20% | 1038 | 4.30% |
|                       | 3 years 1861 | 7.40% | 1038 | 4.30% |
|                       | 4 years 2284 | 9.10% | 1038 | 4.30% |
|                       | 5+ years 13,012 | 51.80% | 1038 | 4.30% |
| Self-Reported After-hours Charting | 0–5 hours 20,912 | 57% | 4460 | 18% |
|                       | 6–15 hours 12,829 | 35% | 1060 | 4.20% |
|                       | 16–25 hours 2473 | 7% | 3976 | 15.80% |
|                       | 25+ hours 732 | 2% | 525 | 2.10% |
| Organizational EHR Supportc | Strongly Agree 4038 | 9% | 1038 | 4.30% |
|                       | Agree 15,386 | 35% | 1038 | 4.30% |
|                       | Indifferent 11,134 | 25% | 1038 | 4.30% |
|                       | Disagree 8511 | 19% | 1038 | 4.30% |
|                       | Strongly Disagree 5,359 | 12% | 1038 | 4.30% |
| Self-Reported Burnout  | Completely burned out 340 | 1% | 4460 | 18% |
|                       | Symptoms of burnout won’t go away 1859 | 7% | 1060 | 4.20% |
|                       | Definitely burning out 5417 | 22% | 3976 | 15.80% |
|                       | Under stress 11,328 | 45% | 1038 | 4.30% |
|                       | No burnout 6074 | 24% | 1038 | 4.30% |

*aHealthcare organizations that have locations in more than 1 region are included multiple times in the geographic region counts.

*bHealthcare organizations that use more than 1 EHR vendor are included multiple times in the EHR vendor counts.

*cAgreement that organization has done a great job with EHR implementation, training, and support.
Table 2. Physician burnout, after-hours charting, and organizational EHR support descriptive statistics

| Specialty                      | Physician n | Organization n | % Of Physicians Burned Out<sup>c</sup> | % of Physicians with 6 or More Hours of Weekly After-hours Charting | Organizational EHR Support<sup>b</sup> |
|--------------------------------|-------------|----------------|-------------------------------------|------------------------------------------------------------------|---------------------------------------|
| All Organizations              | 25,018      | 213            | 30%                                 | 43%                                                              | 44%                                   |
| Family Medicine                | 3,010       | 181            | 34%                                 | 53%                                                              | 47%                                   |
| Hematology/Oncology            | 455         | 129            | 33%                                 | 60%                                                              | 35%                                   |
| Internal Medicine              | 2,164       | 170            | 32%                                 | 53%                                                              | 47%                                   |
| Neurology                      | 459         | 142            | 31%                                 | 52%                                                              | 44%                                   |
| Cardiology                     | 726         | 164            | 30%                                 | 50%                                                              | 38%                                   |
| Radiology                      | 349         | 128            | 29%                                 | 12%                                                              | 35%                                   |
| Gynecology and Obstetrics      | 1,126       | 166            | 29%                                 | 41%                                                              | 43%                                   |
| Pediatrics                     | 1,684       | 176            | 28%                                 | 43%                                                              | 50%                                   |
| Pulmonology                    | 322         | 135            | 28%                                 | 56%                                                              | 39%                                   |
| Emergency Medicine             | 1,391       | 171            | 27%                                 | 31%                                                              | 46%                                   |
| General Surgery                | 895         | 166            | 27%                                 | 40%                                                              | 43%                                   |
| Gastroenterology               | 328         | 147            | 26%                                 | 49%                                                              | 42%                                   |
| Hospital Medicine              | 973         | 141            | 25%                                 | 34%                                                              | 54%                                   |
| Orthopedics                    | 751         | 165            | 25%                                 | 42%                                                              | 37%                                   |
| Anesthesiology                 | 959         | 163            | 24%                                 | 14%                                                              | 49%                                   |
| Psychiatry                     | 465         | 148            | 22%                                 | 37%                                                              | 47%                                   |

<sup>a</sup>Physician specialties with <300 respondents and physicians who did not indicate a specialty were included in the overall analysis but excluded from specialty analyses.

<sup>b</sup>Percent that agree organization has done a great job with EHR implementation, training, and support.

<sup>c</sup>Percent Burned Out is the percent who responded “I am definitely burning out and have 1 or more symptoms of burnout (eg, emotional exhaustion),” “The symptoms of burnout that I am experiencing won’t go away. I think about work frustrations a lot,” or “I feel completely burned out. I am at the point where I may need to seek help.”

**Figure 1.** Associations between 5 hours or fewer of weekly after-hours charting and lower levels of self-reported physician burnout.†

*Significant at *P* < .05
**Significant at *P* < .001
***Significant at *P* < .0001

† Self-reported burnout was measured using a 5-point scale from completely burned out to no burnout with a positive odds ratio indicating lower levels of burnout.

**Note:** Physician specialties with <300 respondents and physicians who did not indicate a specialty were included in the overall analysis but excluded from specialty analyses.
Physicians with 5 or fewer hours of weekly after-hours charting were significantly more likely to report lower levels of burnout for most physician specialties, with the highest odds ratios for gynecology and obstetrics (aOR: 3.34, 95% CI: 2.57, 4.35) and pediatrics (aOR: 3.20, 95% CI: 2.59, 3.94). Physicians who agreed that their organization has done a great job with EHR implementation, training, and support were significantly more likely to report lower levels of burnout for all physician specialties, with the highest odds ratios for cardiology (aOR: 3.28, 95% CI: 2.41, 4.47) and neurology (aOR: 2.74, 95% CI: 1.87, 4.02).

**DISCUSSION**

In our study, after-hours charting was significantly associated with physician burnout. Physicians who reported spending 5 or fewer hours on weekly after-hours charting were significantly more likely to report lower levels of burnout overall and for most included specialties. Several other smaller-scale studies also found an association between after-hours charting and symptoms of burnout.\(^{13,15,16}\) However, the etiology of after-hours charting is multifactorial—clinical work volume and complexity, workflows, staffing, provider EHR mastery, the EHR build, and other factors can all contribute. EHR factors are not solely responsible for after-hours charting, and other efforts besides EHR improvements, such as team documentation and new approaches to care team models, may reduce after-hours charting.

Satisfaction with organizational EHR support was significantly associated with lower levels of burnout overall and for all specialties included in our study, independent of the after-hours charting variable. While the organizational EHR support measurement has not been used in prior literature, previous studies have reported that organizational IT improvements can reduce burnout symptoms.\(^{24-27}\) Our findings suggest that EHR interventions focused on improving organizational EHR support could help reduce physician burnout regardless of the time physicians spend on after-hours charting.

Furthermore, variation in burnout by specialty in this study was notable. The specialties with the highest levels of burnout in our study were family medicine, hematology/oncology, internal medicine, pulmonology, neurology, and cardiology. A nationally representative study also reported that neurology and family medicine were among the specialties with the highest levels of burnout, in addition to urology, nephrology, and diabetes and endocrinology, which were not included in our analyses.\(^{5}\) The specialties with the lowest levels of burnout in our study were psychiatry, gastroenterology, ophthalmology, orthopedics, and hospital medicine. Similarly, a prior study reported that psychiatry, orthopedic, and gastroenterology specialists were among those physicians with the lowest levels of burnout.\(^{5}\) However, we found much lower levels of burnout compared to the prior study which was also on a national scale.\(^{5}\) The difference in the findings for the level of burnout could be related to differences in the burnout measurement and study design.\(^{19-21}\) The overall self-reported burnout in our study is similar to what was found in previous smaller-scale studies examining the relationship between after-hours charting and self-reported burnout.\(^{13,15}\)

We acknowledge that there are limitations to this study. The response rate for some of the participating organizations is not known, which precludes reporting the overall response rate. Our
sample methodology includes a risk of selection and nonresponse bias at both the organization and individual level of unknown direction and magnitude. We were also unable to control for sociodemographic variables such as sex, race, and age because they were not included in data collection. However, we used years practicing medicine as a proxy for age. In addition, while our data include physicians in all 50 states, they are a nonrandom sample and not nationally representative. Our sample disproportionately comes from health systems, with less representation of hospitals that remain independent of health systems. We have an oversampling of organizations using Epic. In our sample, 69% use the Epic EHR, while nationally, 29% of acute-care multispecialty hospitals use Epic. We also likely have an oversample of physicians from the northeast and midwest regions. We included these demographic variables as covariates to help account for these differences. Our study uses self-reported after-hours work which may reflect various inaccuracies, as opposed to objective measures of EHR use outside of scheduled hours. In addition, we collectively assessed EHR implementation, training, and support rather than assessing each individual component. Despite these limitations, this study provides new insights into factors associated with physician burnout and high-risk areas for future research. The large sample of organizations and individual participants allowed us to analyze factors associated with burnout by specialty.

Using the Arch Collaborative database, we found that organizational EHR support and time spent on after-hours charting are independently associated with physician burnout. In addition, these associations and the level of burnout differed by physician specialty. Family medicine had the highest levels of burnout. Gynecology and obstetrics had the highest odds of not being burned out in association with 5 or fewer hours of after-hours charting. Cardiology had the highest odds of not being burned out in association with reporting adequate organizational EHR support. Organizational efforts to reduce after-hours charting and programs directed at supporting the provider’s use of the EHR could mitigate physician burnout. These findings, if verified by other research, may help healthcare organizations allocate and focus time and resources more effectively.

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AUTHOR CONTRIBUTIONS
Conceived study concept: CB, HCE, RC. Conceived study design: CD, JAM, JJ, LCM, RC. Contributed to data analysis and visualization: CD, CL, HCE, JJ. Wrote the manuscript: CB and LCM. All authors reviewed and edited manuscript. All authors approved the final manuscript.

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AVAILABILITY OF DATA
The data underlying this article were provided by KLAS Research by permission. Data will be shared on request to the corresponding author with permission of KLAS Research.

CONFLICT OF INTEREST STATEMENT
KLAS works with most major healthcare IT vendors and consulting firms. Funds from these firms are used to conduct market research and to provide consulting engagements. These funds do not directly support the research presented in this article but are a major source of revenue for KLAS. In addition to these funds, HIT vendors can be members of the Arch Collaborative. Those that are paying members of the collaborative have received consulting engagements and data that are related to this research. Dr. Christopher Longhurst is an uncompensated KLAS advisory board member. Dr. Craig Joseph works for the consulting firm Nordic and formerly worked for the consulting company Axaap.

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