MAYO CLINIC

ORIGINAL ARTICLE

Relationship Between Clerical Burden and Characteristics of the Electronic Environment With Physician Burnout and Professional Satisfaction

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Abstract

Objective: To evaluate associations between the electronic environment, clerical burden, and burnout in US physicians.

Participants and Methods: Physicians across all specialties in the United States were surveyed between August and October 2014. Physicians provided information regarding use of electronic health records (EHRs), computerized physician order entry (CPOE), and electronic patient portals. Burnout was measured using validated metrics.

Results: Of 6375 responding physicians in active practice, 5389 (84.5%) reported that they used EHRs. Of 5892 physicians who indicated that CPOE was relevant to their specialty, 4858 (82.5%) reported using CPOE. Physicians who used EHRs and CPOE had lower satisfaction with the amount of time spent on clerical tasks and higher rates of burnout on univariate analysis. On multivariable analysis, physicians who used EHRs (odds ratio [OR]=0.67; 95% CI, 0.57-0.79; $P<.001$) or CPOE (OR=0.72; 95% CI, 0.62-0.84; $P<.001$) were less likely to be satisfied with the amount of time spent on clerical tasks after adjusting for age, sex, specialty, practice setting, and hours worked per week. Use of CPOE was also associated with a higher risk of burnout after adjusting for these same factors (OR=1.29; 95% CI, 1.12-1.48; $P<.001$). Use of EHRs was not associated with burnout in adjusted models controlling for CPOE and other factors.

Conclusion: In this large national study, physicians' satisfaction with their EHRs and CPOE was generally low. Physicians who used EHRs and CPOE were less satisfied with the amount of time spent on clerical tasks and were at higher risk for professional burnout.

 ■ Mayo Clin Proc. 2016;■■(■):1-13

These are challenging times for American physicians. The medical field is facing unprecedented changes; declining reimbursements, increased productivity expectations, consolidation of medical practices, and increased price competition have intensified the economic pressures on physicians and health care leaders. New legislation and associated regulations have resulted in pay-for-performance measures (eg, Meaningful Use and the Physician Quality Reporting System), development of new care delivery models that may not necessarily be patient focused, and greater consumerism in patient health care decision making. They have also added several new tasks to each patient encounter (eg, medication/device reconciliation) and created new approaches for traditional tasks (eg, e-prescribing).[1-3] Studies suggest that more than half of US physicians are now experiencing professional burnout and that burnout is dramatically more common in physicians than in US workers in other fields.[4,5]

The reasons for the increased rate of physician burnout are complex and include individual and organizational factors. Many physicians have speculated that the more widespread penetration of electronic health records (EHRs), electronic prescribing, electronic patient portals, and computerized physician order entry (CPOE) may lead to information overload, frequent interruptions/distractions, and a change in the content of professional work.[6-9] Although it is hoped that these technological advances may

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improve patient safety and quality of care,[10-16] the available evidence is inconclusive.[17-20] Electronic health records have increased the clerical burden on physicians,[1-3] altered the patient-physician interaction, and can distract from the more meaningful aspects of medical practice.[1-3,7,8,21,22] In many medical centers, EHRs have been paid for by the elimination of transcription services and the implementation of physician self-entry of notes by typing or voice recognition software. These changes appear to have increased the amount of time physicians spend on documentation and other clerical tasks.[23]

Despite the widespread recognition that the evolving electronic environment has dramatically altered the nature of physicians' work, few studies have directly evaluated the relationship between the electronic environment and physician burnout. One of the few studies to directly evaluate this assessed the relationship of satisfaction, stress, and burnout with the number of EHR functions used (eg, clinical notes, laboratory results, imaging reports, prevention reminders, drug interaction warnings, allergy warnings, prescription writing, electronic communications with other physicians, e-mail with patients, and test ordering) in a group of 379 primary care physicians. Statistically significant associations were observed between the number of EHR functions used and physicians' stress and job satisfaction.[24] Notably, this study evaluated physicians between 2001 and 2005 at a time when EHRs and CPOE had not penetrated most practices in the United States and before EHR and CPOE use was governed by federal incentive programs. To evaluate current associations between the electronic environment, clerical burden, and burnout, we conducted a national survey of US physicians in active practice in 2014.

METHODS

A description of the survey administration process, the participation rates, and the demographic characteristics of the overall survey population has been previously reported.[5] The physician sample for the survey was assembled using the American Medical Association Physician Masterfile, a nearly complete record of all US physicians independent of American Medical Association membership, and included physicians of all specialty disciplines. The survey was administered from August 1, 2014, through October 31, 2014. Participation was voluntary, and all responses were anonymous. As previously reported, 6880 of the 35,922 physicians (19.2%) who received an invitation to participate completed surveys.[5] The demographic characteristics of participants relative to all 835,451 US physicians in the Masterfile were generally similar, although participants were older (median age of 56.0 years vs 51.5 years). Of these 6880 responding physicians, the 6560 (95.3%) who were in active clinical practice at the time of the survey were included in the present analysis.

Demographic and Practice Characteristics

Responding physicians provided information regarding basic demographic characteristics (age, sex, and relationship status) and professional characteristics (specialty, practice setting, and hours worked per week). The survey included a mixture of standardized/validated instruments and items developed specifically for this study. Physician burnout was measured using the Maslach Burnout Inventory, a validated 22-item questionnaire considered the gold standard for measuring burnout.[25-28] Consistent with convention,[29-31] we considered physicians with a high score on the depersonalization or emotional exhaustion subscale of the Maslach Burnout Inventory as having at least 1 manifestation of professional burnout.[25] The prevalence of burnout in this sample and comparison with a contemporary population-based sample of US workers from other fields have been previously reported.[5]

Electronic Environment and Clerical Tasks

Physicians also provided information regarding characteristics of the electronic environment in which they practiced. This included questions assessing whether they used EHRs, CPOE, and a patient portal and what method they used to document their clinical work. Physicians who reported that they used EHRs and CPOE were asked to rate their level of satisfaction with these tools. Physicians who used EHRs and patient portals were also asked to indicate their impression of the effects of these tools on quality of care and their efficiency. Satisfaction with clerical tasks directly related to patient care was assessed by asking

TABLE 1. Descriptive Characteristics of the 6560 Physicians Included in the Analysis[a]

Characteristic	Values
Sex	
Male	4276 (67.3)
Female	2075 (32.7)
Missing	209
Age	
Median years	56.0
<35 y	327 (5.2)
35-44 y	1201 (18.9)
45-54 y	1385 (21.8)
55-64 y	2108 (33.2)
≥65 y	1323 (20.9)
Missing	216
Primary care[b]	
Primary care	1530 (23.4)
Not primary care	4996 (76.6)
Missing	32
Specialty	
Anesthesiology	231 (3.6)
Dermatology	162 (2.5)
Emergency medicine	348 (5.4)
Family medicine	510 (7.8)
General surgery	241 (3.7)
General surgery subspecialty	369 (5.7)
Internal medicine—general	435 (6.7)
Internal medicine subspecialty	755 (11.6)
Neurology	239 (3.7)
Neurosurgery	54 (0.8)
Obstetrics/gynecology	282 (4.3)
Ophthalmology	232 (3.6)
Orthopedic surgery	231 (3.6)
Otolaryngology	158 (2.4)
Other	206 (3.2)
Pathology	169 (2.6)
Pediatrics-general	348 (5.4)
Pediatric subspecialty	308 (4.7)
Physical medicine and rehabilitation	168 (2.6)
Preventive/occupational/ environmental medicine	84 (1.3)
Psychiatry	538 (8.3)
Radiation oncology	64 (1.0)
Radiology	252 (3.9)
Urology	114 (1.8)
Missing	62
Hours worked per week	
Median	50.0
<40	1084 (16.7)
40-49	1286 (19.8)
50-59	1618 (24.9)
60-69	1489 (22.9)
70-79	530 (8.1)
≥80	498 (7.7)
Missing	55
No. of nights on call per week (median [interquartile range])	1.0 (0-3.0)
Primary practice setting	
Private practice	3605 (55.2)
Academic medical center	1625 (24.9)
Veterans hospital	104 (1.6)
Active military practice	58 (0.9)
Other	1143 (17.5)
Missing	25
Burnout	
Emotional exhaustion	
Median score	26.0
% Low score	2138 (33.1)
% Intermediate score	1245 (19.3)
% High score	3082 (47.7)
Depersonalization	
Median score	7.0
% Low score	2787 (43.3)
% Intermediate score	1388 (21.5)
% High score	2266 (35.2)
Personal accomplishment	
Median score	41.0
% Low score	3922 (61.4)
% Intermediate score	1438 (22.5)
% High score	1023 (16.0)
Burned out[c,d]	3586 (55.3)

[a]Values are given as No. (percentage) of physcians except where indicated otherwise.

[b]Primary care specialties include internal medicine—general, general practice, family medicine, obstetrics/gynecology, and pediatrics-general.

[c]High score on the emotional exhaustion or depersonalization subscale of the Maslach Burnout Inventory (see the "Methods" section of the text).

[d]6484 physicians responded to burnout questions.

physicians to rate their level of agreement with the statement "the amount of time I spend on clerical tasks related to direct patient care (eg, order entry, dictation, reviewing laboratory results, and communicating with patients via an electronic portal) is reasonable." Similarly, satisfaction with clerical tasks indirectly related to patient care was assessed by asking physicians to rate their level of agreement with the statement "the amount of time I spend on clerical tasks indirectly related to patient care (eg, correspondence, completion of forms, and answering telephone calls) is reasonable." The items evaluating these dimensions of the electronic environment were primarily evaluated using standard agreement (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree) or satisfaction (very satisfied, satisfied, neither satisfied nor dissatisfied,

TABLE 2. Description of Technology Use in Practice[a]

Technology	Physicians (No./total No. [%]) (N=6560)
EHR	
Do you have EHRs?[b]	
Yes	5389/6375 (84.5)
No	986/6375 (15.5)
Rate level of satisfaction with EHRs[c]	
Very satisfied	353/5358 (6.6)
Satisfied	1578/5358 (29.5)
Neither satisfied nor dissatisfied	1086/5358 (20.3)
Dissatisfied	1458/5358 (27.2)
Very dissatisfied	883/5358 (16.5)
EHRs have improved patient care[c]	
Strongly agree	527/5320 (9.9)
Agree	1403/5320 (26.4)
Neither agree nor disagree	1211/5320 (22.8)
Disagree	1142/5320 (21.5)
Strongly disagree	1037/5320 (19.5)
EHRs have improved my efficiency[c]	
Strongly agree	376/5287 (7.1)
Agree	842/5287 (15.9)
Neither agree nor disagree	762/5287 (14.4)
Disagree	1370/5287 (25.9)
Strongly disagree	1937/5287 (36.6)
CPOE	
Do you personally enter orders using a CPOE system?[b]	
Clinic only	1174/6391 (18.4)
Hospital only	1508/6391 (23.6)
Both clinical and hospital	2176/6391 (34.0)
Not at all	1034/6391 (16.2)
Not applicable to my specialty	499/6391 (7.8)
Rate level of satisfaction with CPOE[d]	
Very satisfied	326/4847 (6.7)
Satisfied	1519/4847 (31.3)
Neither satisfied nor dissatisfied	970/4847 (20.0)
Dissatisfied	1373/4847 (28.3)
Very dissatisfied	659/4847 (13.6)
Patient portal	
Do you communicate with patients directly via an electronic patient portal?[b]	
Yes	1658/6360 (26.1)
No	4702/6360 (73.9)
The patient portal has improved patient care[e]	
Strongly agree	136/1650 (8.2)
Agree	446/1650 (27.0)
Neither agree nor disagree	605/1650 (36.7)
Disagree	328/1650 (19.9)
Strongly disagree	135/1650 (8.2)
The patient portal has improved my efficiency[e]	
Strongly agree	97/1650 (5.9)
Agree	265/1650 (16.1)
Neither agree nor disagree	447/1650 (27.1)
Disagree	503/1650 (30.5)
Strongly disagree	338/1650 (20.5)

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dissatisfied, very dissatisfied) scales. A complete list of these questions, along with the response options, is provided in Supplemental Appendix 1 (available online at http://www.mayoclinicproceedings.org).

Statistical Analyses

Standard descriptive summary statistics were used to characterize physician responses. Associations between variables were evaluated using the Kruskal-Wallis test for continuous variables or the χ^2 test for categorical variables as appropriate. All tests were 2-sided with type I error rates of 0.05. Multivariable analysis of differences in satisfaction with clerical burden and burnout was performed using logistic regression. Factors that were included in the models were demographic characteristics (age, sex, specialty, practice setting, and hours worked per week) as well as descriptive characteristics of the responder's electronic practice environment (use of EHRs, patient portals, and CPOE). All analyses were performed using SAS software version 9 (SAS Institute Inc).

RESULTS

The personal and professional characteristics of the 6560 physicians who were in active clinical practice at the time of the survey who were included in this analysis are shown in Table 1.

A description of the electronic practice environment of participating physicians is shown in Table 2. Of the 6375 physicians who replied to the question about whether they used EHRs, 5389 (84.5%) indicated that they did. Of the 5892 physicians who indicated that CPOE was relevant to their specialty, 4858 (82.5%) reported using CPOE, including 1174 of 6391 (18.4%) who used CPOE in the clinic, 1508 of 6391 (23.6%) who used CPOE in the hospital, and 2176 of 6391 (34.0%) who used CPOE in both settings. Slightly more than 1 in 4 physicians (1658 of 6360; 26.1%) reported communicating directly with patients via an electronic patient portal.

Of 5358 physicians who used EHRs, 1931 (36.0%) were satisfied or very satisfied with their EHRs and 2341 (43.7%) were dissatisfied or very dissatisfied. Satisfaction with EHRs also varied by specialty (Figure 1). Of 4847

physicians who used CPOE, 1845 (38.1%) were satisfied or very satisfied with CPOE and 2032 (41.9%) were dissatisfied or very dissatisfied. Physicians had mixed opinions regarding the effects of EHRs and patient portals on patient care. Of 5320 EHR users, 1930 (36.3%) agreed or strongly agreed that EHRs had improved patient care and 2179 (41.0%) disagreed or strongly disagreed. Of the 1650 patient portal users, 582 (35.3%) agreed or strongly agreed that the portal had improved patient care and 463 (28.1%) disagreed or strongly disagreed with this sentiment. Physicians had even less favorable views regarding the effects of EHRs and patient portals on their efficiency. A total of 1218 of 5287 physicians (23.0%) believed that EHRs had improved their efficiency, and 3307 (62.5%) disagreed with this notion. Similarly, only 362 of 1650 physicians (21.9%) using a patient portal believed that it had increased their efficiency, and 841 (51.0%) disagreed with this notion.

Overall, 2365 of 6343 physicians (37.3%) agreed or strongly agreed that the amount of time spent on clerical tasks related to direct patient care (eg, order entry, dictation, reviewing laboratory results, and communicating with patients via an electronic portal) was reasonable, and 2950 (46.5%) disagreed or strongly disagreed (Table 2). Physicians also had an unfavorable view of the amount of time spent on clerical tasks indirectly related to patient care (eg, correspondence, completion of forms, and answering telephone calls). In this dimension, 1623 of 6326 physicians (25.7%) agreed or strongly agreed that the amount of time spent was reasonable and 3528 (55.8%) disagreed or strongly disagreed. Satisfaction with clerical burden varied by specialty, with the highest satisfaction among pathologists and radiologists and the lowest satisfaction among urologists, family medicine physicians, and otolaryngologists (Figure 2). Categorization of the 24 specialty disciplines based on the prevalence of burnout and whether their satisfaction with clerical burden was above or below the prevalence of all US physicians in each dimension is shown in Figure 3.

Satisfaction with EHRs, CPOE, and clerical burden varied by age, with greater satisfaction among younger physicians. Of the physicians younger than 40 years, 396 of 863 (45.9%) were satisfied with their EHRs compared with 367 of 971 (37.8%) of those aged 40 to 49 years, 512 of 1606 (31.9%) of those aged 50 to 59 years, and 594 of 1752 (33.9%) of those 60 years and older ($P<.001$). Similar trends were observed for satisfaction with CPOE and clerical burden (Supplemental Table 1, available online at http://www.mayoclinicproceedings.org).

Next, we evaluated the relationship between use of EHRs, CPOE, and patient portals; method of documentation; and satisfaction with clerical burden and burnout (Table 3). Physicians who used EHRs, CPOE, and patient portals had lower satisfaction with

TABLE 2. Continued

Technology	Physicians (No./total No. [%]) (N=6560)
Method of documentation	
How do you enter most of your notes?[b]	
Dictate and use transcription service	941/6360 (14.8)
Self-enter: voice recognition software	921/6360 (14.5)
Self-enter: handwritten or typed	3915/6360 (61.6)
Someone else (eg, scribe) enters for me	284/6360 (4.5)
Other	299/6360 (4.7)
View of clerical tasks	
Amount of time I spend on clerical tasks related to direct patient care[f] is reasonable	
Strongly agree	488 (7.7)
Agree	1877 (29.6)
Neither agree nor disagree	925 (14.6)
Disagree	1455 (22.9)
Strongly disagree	1495 (23.6)
Don't know/not applicable	103 (1.6)
Missing	217
Amount of time I spend on clerical tasks indirectly related to patient care[g] is reasonable	
Strongly agree	294 (4.6)
Agree	1329 (21.0)
Neither agree nor disagree	1051 (16.6)
Disagree	1594 (25.2)
Strongly disagree	1934 (30.6)
Don't know/not applicable	124 (2.0)
Missing	234

[a]CPOE = computerized physician order entry; EHR = electronic health record.
[b]Total less than 6560 reflects incomplete survey responses.
[c]Of those who indicated that they had EHRs.
[d]Of those who used CPOE (clinic, hospital, or both).
[e]Of those who used a patient portal.
[f]For example, order entry, dictation, reviewing laboratory results, and communicating with patients via an electronic portal.
[g]For example, correspondence, completion of forms, and answering telephone calls.

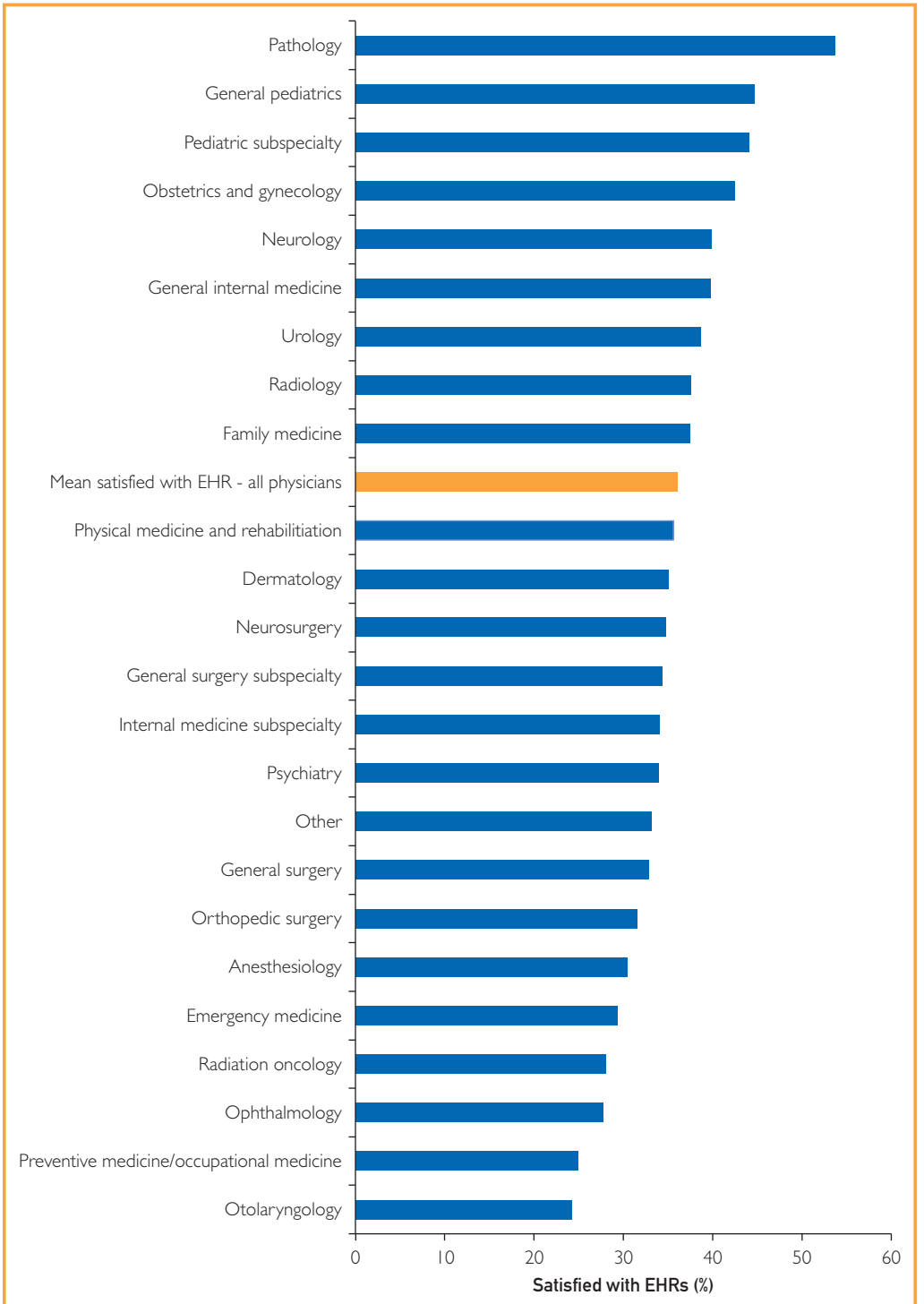

FIGURE 1. Satisfaction (satisfied or very satisfied) with electronic health records (EHRs) by specialty.

clerical burden directly and indirectly related to patient care. Those who used EHRs and CPOE also had higher rates of burnout. Regarding method of documentation, self-entry of notes using voice recognition software was associated with lower satisfaction with clerical burden directly related to patient care and higher rates of burnout.

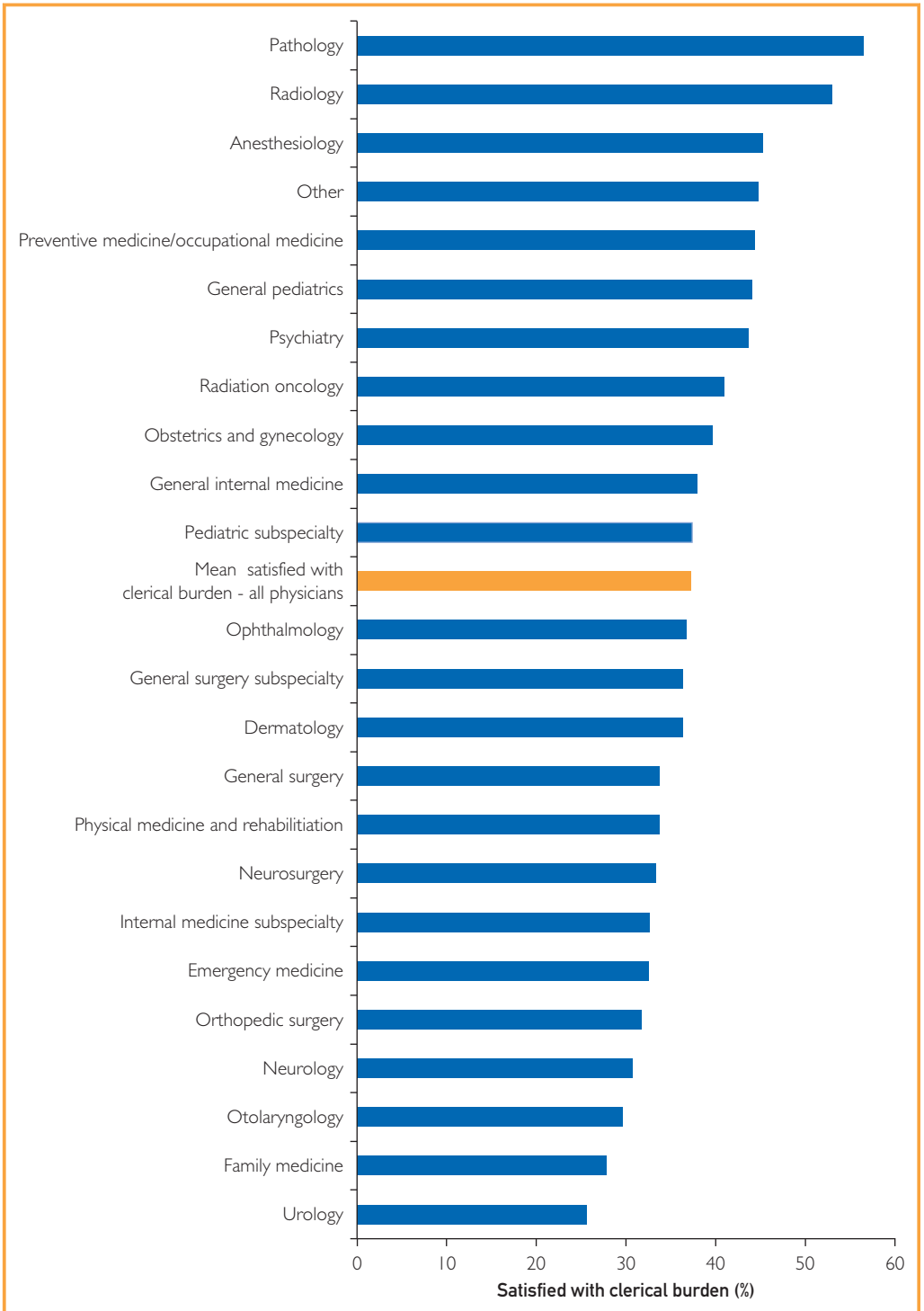

FIGURE 2. Satisfaction (satisfied or very satisfied) with clerical burden directly related to patient care by specialty.

Finally, we performed 2 separate multivariable analyses to identify factors independently associated with satisfaction with the clerical burden directly related to patient care and burnout. Physicians who used EHRs or CPOE were less likely to be satisfied with clerical burden directly related to patient care after adjusting for age, sex, specialty, practice

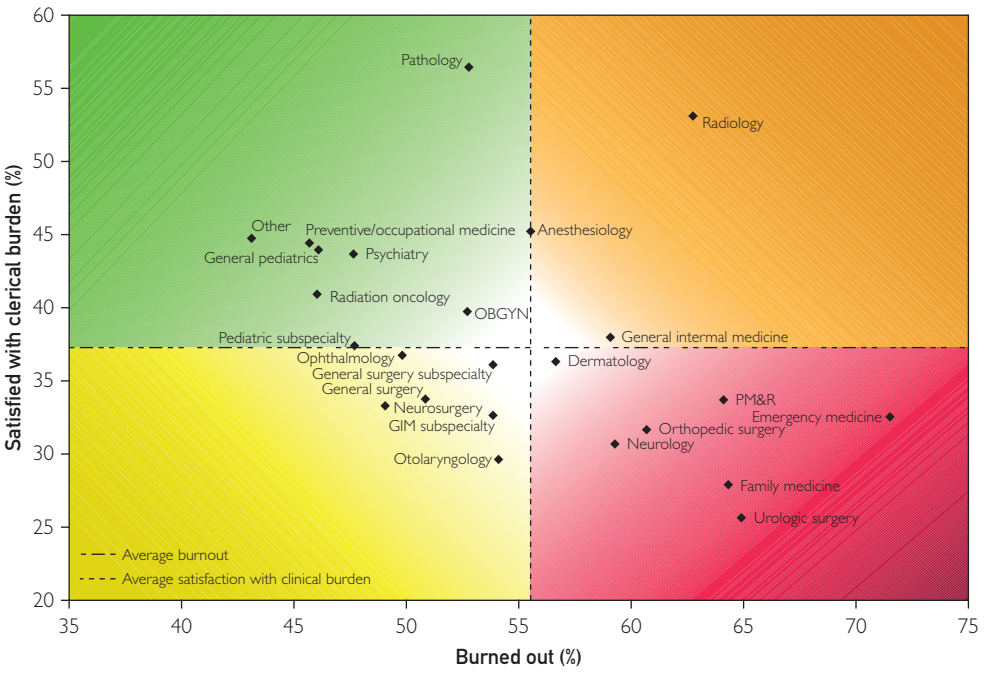

FIGURE 3. Prevalence of burnout and satisfaction (satisfied or very satisfied) with clerical burden directly related to patient care by specialty. GIM = general internal medicine; OBGYN = obstetrics/gynecology; PM&R = physical medicine and rehabilitation.

setting, and hours worked per week (Table 4). Use of CPOE (but not use of EHRs) was also associated with a higher risk of burnout after adjusting for age, sex, specialty, practice setting, and hours worked per week (Table 4). Use of a patient portal was not independently associated with either satisfaction with clerical burden or burnout in adjusted analyses. Similar analyses exploring factors independently associated with satisfaction with clerical burden indirectly related to patient care are provided in Supplemental Table 2 (available online at http://www.mayoclinicproceedings.org).

DISCUSSION

The present study chronicles the widespread evolution of the electronic environment in the US healthcare system and its effect on physicians. In 2008, less than 15% of medical practices used EHRs and less than 5% had fully functional EHRs that incorporated test ordering, electronic prescribing, decision support tools, and medical images.[32] By 2012 these proportions had increased to 72% and 40%.[33,34] In the present study of US physicians across all specialties, more than 80% reported using EHRs and approximately 75% reported using some form of CPOE. Far fewer physicians (approximately 25%) interacted with patients via an electronic patient portal.

Physician satisfaction with their EHRs and CPOE was generally low. Despite the expectation that these tools would improve patient outcomes,[10-16] physician opinion was nearly evenly split on whether they had actually improved patient care. Physicians reported widespread dissatisfaction with the clerical burden associated with these tools, with only approximately 1 in 3 believing that the amount of time spent on clerical tasks directly related to patient care (eg, order entry, dictation, reviewing laboratory results, and communicating with patients via an electronic portal) was reasonable and only 1 in 4 believing that the amount of time spent on clerical tasks indirectly related to patient care (eg, correspondence, completion of forms, and answering telephone calls) was reasonable. Physicians who used EHRs, CPOE, or a

TABLE 3. Relationship of EHR, CPOE, Patient Portal Use and Method of Documentation With Satisfaction, Clerical Burden and Burnout[a]

Factor	Satisfied[b] clerical directly related to patient care (No. [%])	*P* value	Satisfied[b] clerical indirectly related to patient care (No. [%])	*P* value	Burnout (No. [%])	*P* value
Use EHRs		<.001		<.001		<.001
Yes	1880/5329 (35.3)		1308/5312 (24.6)		3056/5340 (57.2)	
No	472/971 (48.6)		306/971 (31.5)		434/974 (44.6)	
Use CPOE		<.001		<.001		<.001
Clinic only	369/1169 (31.6)		257/1158 (22.2)		648/1162 (55.8)	
Hospital only	566/1490 (38.0)		392/1488 (26.3)		886/1496 (59.2)	
Both clinical and hospital	691/2153 (32.1)		440/2147 (20.5)		1273/2163 (58.9)	
Not at all	475/1015 (46.8)		332/1018 (32.6)		461/1021 (45.2)	
Not applicable to my specialty	252/490 (51.4)	NA	193/489 (39.5)	NA	229/488 (46.9)	NA
Use an electronic patient portal		.001		<.001		.49
Yes	547/1645 (33.3)		336/1636 (20.5)		923/1647 (56.0)	
No	1796/4644 (38.7)		1273/4637 (27.5)		2562/4654 (55.0)	
Method of documentation		.005		.11		.02
Dictate and use transcription service	364/928 (39.2)		244/927 (26.3)		492/932 (52.8)	
Self-enter: voice recognition software	296/909 (32.6)		204/909 (22.4)		535/908 (58.9)	
Self-enter: handwritten or typed	1482/3882 (38.2)		999/3868 (25.8)		2154/3884 (55.5)	
Someone else (eg, scribe) enters for me	109/277 (39.4)		79/276 (28.6)		154/282 (54.6)	
Other	97/297 (32.7)		84/296 (28.4)		146/296 (49.3)	

[a]CPOE = computerized physician order entry; EHR = electronic health record; NA = not applicable.
[b]Agree or strongly agree that the amount of time spent on clerical tasks in this dimension is reasonable.

patient portal had lower satisfaction with both dimensions of clerical burden, and, by a greater than 2 to 1 margin, physicians disagreed with the notion that their EHRs or patient portal had improved their efficiency.

To our knowledge, this is one of only a few studies to evaluate the relationship between the electronic environment and physician burnout. Physicians who used EHRs or CPOE were at higher risk for burnout regardless of whether they were or were not satisfied with their EHRs or CPOE. In multivariable analysis adjusting for age, sex, specialty, practice setting, hours worked per week, and EHR use, CPOE seemed to be the driving factor in the relationship between the electronic environment and physician burnout. Physicians using CPOE had an approximately 30% higher risk of burnout after adjusting for all other factors.

Although some evidence suggests that the use of EHRs, electronic prescribing, and CPOE may improve patient outcomes[10-16] the evidence is inconclusive,[17-20] and these tools also create clerical burden, cognitive burden, and frequent interruptions/distractions that may threaten the potentially beneficial effects.[7,8,35] Based on the data presented herein, they are also associated with an increased risk of burnout among physicians. Burnout has been shown to erode quality of care, increase risk of medical errors, and lead physicians to reduce clinical work hours,[36-44] suggesting that the net effect of these electronic tools on quality of care for the US health care system is less clear.

How do we harness the value of these tools and simultaneously mitigate their negative effects on physicians? The simple answer would seem to be finding ways to incorporate EHRs, patient portals, and CPOE in a manner that does not increase clerical burden for physicians or reduce their efficiency. Understanding which EHR functions pose the greatest challenges for physicians may help identify the areas that provide the greatest opportunity for redesign of practice-relevant operational processes. A variety of studies have begun to chronicle innovative ways to ease the clerical burden and distractions that the electronic environment can create for physicians. For example, 2 promising approaches involve assistant order entry and documentation support. In one model, medical scribes help chart

TABLE 4. Multivariate Analysis of Factors Related to Satisfaction With Clerical Burden and Burnout[a]

Dependent variable	Predictor	OR (95% CI)	*P* value
A. Factors independently associated with satisfaction with clerical burden directly related to patient care[b]			
Agree that clerical burden directly related to patient care is reasonable	Age (for each year older)	0.984 (0.979-0.988)	<.001
	Emergency medicine (vs IM-general)	0.641 (0.469-0.877)	.005
	Family medicine (vs IM-general)	0.570 (0.427-0.762)	.001
	Pathology (vs IM-general)	1.782 (1.202-2.639)	.004
	Radiology (vs IM-general)	1.555 (1.110-2.177)	.01
	Hours (for each additional hour per week)	0.982 (0.978-0.985)	<.001
	Uses EHRs (vs not)	0.668 (0.567-0.787)	<.001
	Uses CPOE (vs not)	0.720 (0.620-0.835)	<.001
B. Factors independently associated with burnout[b]			
Burned out	Age (for each year older)	0.974 (0.969-0.978)	<.001
	Female (vs male)	1.355 (1.194-1.536)	<.001
	Emergency medicine (vs IM-general)	2.125 (1.538-2.935)	<.001
	Family medicine (vs IM-general)	1.379 (1.036-1.834)	.03
	Surgical subspecialty (vs IM-general)	0.626 (0.445-0.880)	.007
	General pediatrics (vs IM-general)	0.602 (0.442-0.819)	.001
	General surgery (vs IM-general)	0.598 (0.427-0.839)	.003
	OBGYN (vs IM-general)	0.710 (0.511-0.985)	.04
	Pediatric subspecialty (vs IM-general)	0.698 (0.505-0.965)	.03
	Radiology (vs IM-general)	1.442 (1.017-2.045)	.04
	Academic practice (vs private)	0.692 (0.604-0.792)	<.001
	Hours (for each additional hour per week)	1.025 (1.021-1.029)	<.001
	Uses CPOE (vs not)	1.289 (1.120-1.483)	<.001

[a]CPOE = computerized physician order entry; EHR = electronic health record; IM = internal medicine; OBGYN = obstetrics/gynecology; OR = odds ratio.

[b]Factors in the model: age, sex, specialty, practice setting (private, academic, veterans affairs, or military), hours worked per week, use EHRs (yes/no), use a patient portal (yes/no), and use CPOE.

the patient-physician encounter in the EHR in real time under the direction of a physician.[45,46] Although the current body of evidence is limited, a recent systematic review suggested that the use of scribes increased physician efficiency, enhanced physician satisfaction, increased the volume of patients cared for, and increased hourly relative value units generated by physicians, with a neutral or positive effect on patient satisfaction.[47] Advanced care team models may be an even more powerful strategy.[48-50] With this approach, a clinically trained individual (nurse, medical assistant, or specialty technician) assists with visit note documentation, nonphysician order entry, inbox management, health coaching, and care coordination.[48-50] This approach also utilizes nursing support to triage and responds to patient portal messages and other electronic communications. Other approaches to improving efficiency such as value stream mapping and process standardization have also been reported to be helpful.[51]

The present findings also suggest that there may be a generational dimension to the effect of the electronic environment on physicians. Younger physicians were generally more satisfied with their electronic environment and CPOE. Older physicians have had to adjust to change, whereas the EHR era may be all that younger physicians have ever experienced.[52] Nonetheless, a majority of younger physicians in this national study were still dissatisfied with the effects of the EHR and with clerical burden, and the multivariable analysis indicates that EHR and CPOE use had adverse effects on clerical burden and risk of burnout independent of age.

As several researchers have eloquently noted,[21,22] the introduction and widespread use of EHRs, CPOE, and electronic prescribing have broader implications for the physician-patient interaction than their effect on physician

Mayo Clin Proc. ■ XXX 2016;■■(■):1-13 ■ http://dx.doi.org/10.1016/j.mayocp.2016.05.007
www.mayoclinicproceedings.org

efficiency and clerical burden. Although most of the discussion on how the electronic environment affects physician satisfaction has focused on clerical burden/inefficiency, the electronic environment has the potential to affect several other dimensions of physician satisfaction, including erosion of control/autonomy through greater regulation (eg, Meaningful Use) and adverse effects on work-life integration. The introduction of computers into the examination room has the potential to shift physicians' focus away from the patient and the human interaction, which is a source of meaning for physicians. Limited data also suggest that introducing a computer into the examination room results in lower patient satisfaction.[53] Other studies suggest that it may have either a positive or negative effect depending on how the computer is integrated into the encounter.[9,54,55] Studies of resident physicians suggest that EHR use may actually increase communication with patients[52] and that training in how to integrate the EHR into the encounter in a patient-centered way may increase physicians' ability to engage patients rather than have the EHR be a distraction.[56]

This study is subject to a variety of limitations. Although consistent with other national surveys of physicians,[57-59] the participation rate among physicians in this study was only 19%. Although we found minimal differences between early and late responders (a standard approach to evaluate for response bias) with respect to age, sex, and specialty, physicians using EHRs, CPOE, or a patient portal may be more technologically savvy and more likely to participate. This study is cross-sectional and cannot determine cause and effect. We also did not inquire as to which specific EHRs physicians used to evaluate whether some are perceived as more physician friendly than others. It should also be noted that a variety of factors independent of the electronic environment contribute to clerical burden (eg, insurer-required precertifications). Although the association of EHRs and CPOE with clerical burden persisted on the multivariate analysis, we are unable to adjust for every factor that may contribute to clerical burden.

CONCLUSION

Electronic health records, CPOE, and patient portals are here to stay. These tools hold great promise for enhancing coordination of care, reducing errors, and improving quality of care.[10-16] In their current form and implementation, however, they seem to have had a variety of unintended negative consequences that reduce efficiency, increase clerical burden, and increase the risk of burnout for physicians. Further studies are needed to investigate whether the associations observed are causal. Innovative approaches that incorporate these electronic tools into practice without adversely affecting physician efficiency and professional satisfaction are needed.

SUPPLEMENTAL ONLINE MATERIAL

Supplemental material can be found online at http://www.mayoclinicproceedings.org. Supplemental material attached to journal articles has not been edited, and the authors take responsibility for the accuracy of all data.

Abbreviations and Acronyms: **CPOE** = computerized physician order entry; **EHR** = electronic health record; **GIM** = general internal medicine; **IM** = internal medicine; **OBGYN** = obstetrics/gynecology; **OR** = odds ratio; **PM&R** = physical medicine and rehabilitation

Grant Support: Funding for this study was provided by the Mayo Clinic Program on Physician Well-being.

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