Impact of Electronic Health Records on Malpractice Claims in a Sample of Physician Offices in Colorado: A Retrospective Cohort Study

Michael S. Victoroff, MD¹, Barbara M. Drury, BA², Elizabeth J. Campagna, MS, PStat^{®3}, and Elaine H. Morrato, DrPH, MPH^{4,5}

¹Department of Family Medicine, University of Colorado School of Medicine, Centennial, CO, USA; ²Pricare, Inc., Larkspur, CO, USA;

³Colorado Health Outcomes Program, University of Colorado School of Medicine, Aurora, CO, USA; ⁴Department of Health Systems, Management and Policy, Colorado School of Public Health, Colorado Health Outcomes Program, University of Colorado School of Public Health, Aurora, CO, USA; ⁵Department of Health Systems, Management and Policy, Colorado School of Public Health, Colorado Health Outcomes Program, University of Colorado School of Medicine, Aurora, CO, USA.

BACKGROUND: Electronic health records (EHRs) might reduce medical liability claims and potentially justify premium credits from liability insurers, but the evidence is limited.

OBJECTIVES: To evaluate the association between EHR use and medical liability claims in a population of office-based physicians, including claims that could potentially be directly prevented by features available in EHRs (“EHR-sensitive” claims).

DESIGN: Retrospective cohort study of medical liability claims and analysis of claim abstracts.

PARTICIPANTS: The 26 % of Colorado office-based physicians insured through COPIC Insurance Company who responded to a survey on EHR use (894 respondents out of 3,502 invitees).

MAIN MEASURES: Claims incidence rate ratio (IRR); prevalence of “EHR-sensitive” claims.

KEY RESULTS: 473 physicians (53 % of respondents) used an office-based EHR. After adjustment for sex, birth cohort, specialty, practice setting and use of an EHR in settings other than an office, IRR for all claims was not significantly different between EHR users and non-users (0.88, 95 % CI 0.52–1.46; $p=0.61$), or for users after EHR implementation as compared to before (0.73, 95 % CI 0.41–1.29; $p=0.28$). Of 1,569 claim abstracts reviewed, 3 % were judged “Plausibly EHR-sensitive,” 82 % “Unlikely EHR-sensitive,” and 15 % “Unable to determine.” EHR-sensitive claims occurred in six out of 633 non-users and two out of 251 EHR users. Incidence rate ratios were 0.01 for both groups.

CONCLUSIONS: Colorado physicians using office-based EHRs did not have significantly different rates of liability claims than non-EHR users; nor were rates different for EHR users before and after EHR implementation. The lack of significant effect may be due to a low prevalence of EHR-sensitive claims. Further re-

search on EHR use and medical liability across a larger population of physicians is warranted.

KEY WORDS: electronic health records; professional liability; office-based practice.

J Gen Intern Med 28(5):637–44

DOI: 10.1007/s11606-012-2283-2

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INTRODUCTION

The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 authorized \$27 billion to support physician adoption of Electronic Health Records (EHRs). It assumes 70 % of eligible professionals will use EHRs by 2020.¹ According to the National Center for Health Statistics, 57 % of office-based physicians used some form of EHR in 2011 (compared to 18 % in 2001), with 34 % meeting criteria for a “basic system.”² Increasing reliance on EHRs demands evaluation of their impacts on healthcare processes and outcomes.

Some research suggests EHRs can improve clinical quality^{3–8} and patient safety.⁹ There is mixed data on their ability to reduce healthcare costs^{10,11} or improve physician efficiency.¹² There is wide interest in understanding the impact on professional liability. Forty-five percent of physicians in a 2007 internet survey felt that an EHR would reduce their malpractice risk.¹³ Presumably, this might occur as a direct effect of forestalling EHR-sensitive errors, or as a “halo effect” of practice re-engineering during EHR implementation. Tempering this expectation is growing awareness of adverse events induced by EHRs.^{14–16} Since the early days of EHRs, providers have asked liability carriers if a hypothetical reduction in liability costs might warrant a credit against premiums. Currently, some carriers do offer direct or indirect premium reductions for EHR use.^{17,18} However, the actuarial basis for this is unclear.

Electronic supplementary material The online version of this article (doi:10.1007/s11606-012-2283-2) contains supplementary material, which is available to authorized users.

Received March 28, 2012

Revised August 15, 2012

Accepted October 29, 2012

Published online November 29, 2012

Data on the impact of EHRs on medical liability risk is sparse. A single, cross-sectional study from Massachusetts found a suggestion of lower rates of paid malpractice claims (a subset of filed claims) with EHR use. However, after controlling for physician characteristics the effect was not statistically significant.¹⁹ Importantly, that study's design could not investigate the timing of EHR implementation relative to the dates of events precipitating claims. In addition, its source of data (the Massachusetts Board of Registration in Medicine, 1997–2007) excluded claims without payment, yielding a highly filtered subset. Nor did the authors adjust for exposure (years in practice), or have access to event descriptions to assess the potential EHR-sensitivity of claims, which is essential to support a causal association between EHR use and reduced liability. A 2012 follow-up again found a trend toward lower paid claims among EHR-users, but had the same limitations as the prior report.²⁰

To better evaluate the impact of EHRs upon ambulatory liability claims and address the limitations of prior studies, we conducted a cohort study of claims for Colorado physicians insured by COPIC Insurance Company between 1982 and 2009. COPIC covered 6,005 Colorado physicians in 2009, representing about 75 % of those not covered by governmental immunity or self-insured organizations. COPIC data have been used for several research studies and reports investigating medical error.^{21,22}

Our null hypothesis was that EHR-use did not significantly impact the rate of medical liability claims among office-based physicians. If EHRs did reduce claims, this could be through direct or indirect mechanisms. They might directly prevent adverse events that are sensitive to a specific EHR function. Also, they might indirectly improve practice quality, for example by making staff more diligent or efficient, making information more available, or through changes in workflow. To look for evidence of any effect or a direct effect, we analyzed the association between EHR use on any claim and “EHR-sensitive” claims, respectively.

METHODS

Medical Liability Claims

A retrospective cohort study was conducted using COPIC medical liability claim data from 1982 to 2009 for office-based physicians in Colorado. A claim was defined as a complaint requiring consultation with an attorney, regardless of how it was resolved. All COPIC claims must be initiated by a call between the insured and COPIC's Risk Management Department. Insureds report adverse events (including complaints or notices received) to a nurse who records a brief summary as an “occurrence” report. COPIC's Claims Department then makes a judgment whether an occurrence should escalate to become a claim. Since 2002, these summaries have been captured electronically, allowing them

to be conveniently reviewed. Because expenses (defense costs and indemnity payments) are subject to numerous confounders and would have limited the sample to closed claims, expenses were not included in this analysis.

Claims history was analyzed for each study-eligible physician. Hospital-based physicians (e.g., hospitalists, surgeons, anesthesiologists) and mental health providers were excluded. Years of coverage were calculated from COPIC enrollment dates. Because lag between adverse events and occurrence reports can be 1–2 years, counting the first years of coverage for new subscribers would bias the data in the direction of fewer claims per covered year. Therefore, the calculation of incidence rates per covered year was restricted to physicians covered for at least 3 years.

EHR Use

EHR use and year of first use were obtained from a survey conducted among COPIC Colorado insureds practicing in ambulatory settings in November/December 2009 (Fig. 1). 3,502 physicians were invited to participate, and 894 reported EHR status (26 % response rate). EHR use was determined by the question, “Do you currently use an electronic health record (EMR/EHR)?” Positive responders were asked to classify use as “office only,” “non-office only,” or “both.” Date of adoption was defined as December 31st of the reported year of first use. Online supplemental materials are included with more information on the survey, including the cumulative percent of respondents using EHRs by year of adoption (eFig. 1), characteristics of respondents using EHRs by year of adoption (eTable 1), aggregate survey responses from those using EHRs (eTable 2), and the survey questions (eTable 3).

To analyze the EHR-sensitivity of ambulatory claims, we adapted a scheme used for evaluating EHR-sensitivity of hospital claims (Mangalmurti et al.,²³ Jha et al.²⁴ and Blumenthal et al.²⁵). To develop this scheme, we considered four EHR functionalities likely to reduce adverse events in the ambulatory setting: 1) reminder systems, 2) e-Prescribing, 3) clinical communication, and 4) decision support. Two authors (MV, BD) independently analyzed 1,569 summaries that were electronically available for claims associated with the study-eligible physicians, to identify events likely preventable by functions typically available in ambulatory EHRs. The electronic abstracts included claims from 58 events occurring in 1999–2001 and all claims (1,511) from 2002 to 2009. Reviewers were blinded to physician identity, EHR-use and survey participation. Claims were categorized “Plausibly EHR-sensitive,” “Unlikely EHR-sensitive” or “Unable to determine.” Inter-rater reliability was poor during independent review (Cohen's kappa=0.36). After independent adjudication, disagreements were resolved by consensus. Examples of categorizations and illustrative cases appear in eTable 4.

Figure 1. Study flow diagram.

Statistical Analysis

First, the association was examined between physician and practice characteristics and EHR use. For univariate analyses, Pearson's chi-square test of association was used to compare proportions and Student's *t*-test to compare distributions. EHR use was modeled using multivariable logistic regression that included gender, birth cohort, type of practice, practice setting, number of patients seen per week, and use of a non-office EHR. Details of EHR use were obtained from the survey.

Claim rate was modeled using a two-stage, zero-inflated, negative binomial regression model to account for overdispersion and excess zeros associated with subjects without claims. Pairwise comparisons were made between three cohorts: 1) EHR users pre-implementation versus non-users, 2) EHR users post-implementation versus non-users, and 3) EHR users pre-implementation versus post-implementation. The first stage adjusted for cohort. The second stage additionally controlled for physician and practice characteristics of gender, birth cohort, specialty group, practice setting, and non-office EHR use. In the comparison between EHR users pre-implementation and post-implementation, repeated measures on individuals were accounted for using the Huber/

White/sandwich estimator of variance. Estimates from the second stage of the model use incidence rate ratios (IRR). IRR is the ratio of the incidence rates for the two cohorts of comparison; for example, the number of new claims per 10 covered years among EHR users pre-implementation compared to non-users. To adjust for variation in covered years, claim incidence was reported as a rate per 10 covered years.

EHR adoption was not random; therefore, an attempt was made to identify an instrumental variable (used to estimate causal relationships when randomized experiments are not feasible). A valid instrumental variable would predict EHR adoption without independently also predicting the outcome. However, of available physician and practice factors, none predicted only EHR adoption without also predicting claims; thus, a valid instrumental variable was not found. Sensitivity analyses to evaluate effects driven by outliers (> 90th percentile) were performed, excluding a) physicians with more than three claims, and b) physicians with more than 26.5 covered years.

In addition to examining the effect of EHR use on the incidence of any claim, the association between EHR use and EHR-sensitive claims was also examined, first between EHR users versus non-users, and then among EHR users

relative to year of implementation. Fisher's exact test was used for comparisons, due to small cell counts.

Analyses used SAS version 9.3 (SAS Institute, Inc., Cary, NC) or Stata 10.1 (Stata Corporation, College Station, TX). Data analysis was approved by the Colorado Multiple Institutional Review Board (COMIRB).

RESULTS

Respondents did not differ significantly from non-respondents in sex, age, years since medical school graduation, type of practice or prevalence of liability claims. Respondents had longer COPIC coverage by 1.1 years, which was statistically significant (13.7 vs. 12.6; $P < 0.01$) (see Table 1).

Characteristics of Office-Based EHR Users and Usage

Table 2 summarizes physician and practice characteristics associated with EHR use. 473 of 894 survey respondents (53 %) reported current use of an office-based EHR. Use was significantly associated with birth cohort; also physicians in multispecialty group practice were more likely to use an EHR than physicians in primary care group practice, and more likely than physicians in solo or single-specialty practice.

Association Between EHR Use and Any Malpractice Claim

Only 50 % of respondents ever had a medical liability claim. There were 11,561 covered years of observation in

the sample, 5,321 among EHR users and 6,240 among non-users. Among EHR users, there were 3,966 covered years before implementation and 1,355 after.

Table 3 compares medical liability claims between EHR users and non-users, and between EHR users before and after implementation. There were 393 claims among non-users, giving an average incidence rate (AIR) per physician of 0.78 per 10 covered years. Among EHR users there were 315 claims pre-implementation (AIR=0.98) and 237 post-implementation (AIR=0.42). EHR users prior to EHR implementation had a higher unadjusted incident rate ratio than non-users (IRR=1.23, CI: 1.01–1.51; $p=0.04$). The difference was not statistically significant after accounting for sex, birth cohort, specialty group, practice setting and non-office EHR use (adjusted IRR=1.18, CI 0.97–1.45; $p=0.10$). EHR users post-implementation did not have a significantly different adjusted incidence rate ratio than non-users (adjusted IRR=0.88, CI: 0.52–1.46; $p=0.61$). Moreover, EHR users post-implementation did not have significantly different adjusted rates compared to pre-implementation (adjusted IRR=0.73, CI: 0.41–1.29; $p=0.28$). Sensitivity analyses showed these results to be robust with respect to outliers and gaps in insurance coverage.

Analysis of EHR-Sensitive Claims

Table 4 shows that, of 394 claims associated with respondents with known EHR status, 13 (3 %) were judged plausibly EHR-sensitive and 322 (82 %) unlikely to be EHR-sensitive; no determination could be made for 59 (15 %). (This distribution was not different for 1,175 claims associated with survey non-respondents; $p=0.75$). Of note, no claims appeared to be caused by EHRs. The 13 EHR-sensitive claims were categorized according to the EHR function that might have prevented the event giving rise to the claim: "Tracking" 11 (85 %) and "e-Prescribing" two (15 %). No claims among survey respondents were associated with "Communication" or "Decision Support," although some were seen among non-respondents. Three EHR-sensitive claims appeared among 61 in practices with EHRs, compared to 10 EHR-sensitive claims among 333 in practices without EHRs (4.9 % versus 3.0 %; $p=0.37$). Incidence of EHR-sensitive claims was 0.01 claims per 10 covered years, regardless of EHR use (Table 5).

DISCUSSION

In a 28-year, retrospective study of 894 office-based physicians in Colorado, we were not able to demonstrate that use of an Electronic Health Record was associated with a statistically significant effect on medical liability claim rates. Adjusted claim rates were similar for EHR users before and after implementation, and for EHR users versus

Table 1. Characteristics of the Survey Responders and Non-Responders*

Characteristic	Respondent (n=897)	Non-respondent (n=2,605)	P-value†
Male	597 (66.6)	1,705 (65.5)	0.55
Age, years	50.0±10.3	50.4±10.9	0.36
Years since medical school graduation	22.5±10.7	22.6±11.4	0.83
Type of office-based practice			
Primary care	611 (68.1)	1,729 (66.4)	} 0.62
Medical specialty	247 (27.5)	761 (29.2)	
Surgical specialty	39 (4.3)	115 (4.4)	
COPIC covered years	13.7±8.2	12.6±8.3	< 0.001
Had a liability claim (≥ 1)	451 (50.3)	1,223 (46.9)	0.09

*Survey administered to Colorado office-based physicians November–December 2009. Values reported as n (column %) or mean ± SD. Physicians were directed to an online questionnaire of 26 items. They logged in with their unique COPIC Insurance Company ID numbers, which were anonymized in reporting. Complete survey questions are shown in eTable 3. Returning a survey gained respondents a risk management credit that could accumulate toward earning a premium discount.

†P-values were calculated using Pearson's chi-square test of association to compare proportions and Student's t-test to compare distributions.

Table 2. Physician and Practice Characteristics Associated With Current Use of Office-Based EHR*

Selected characteristics†	All (N=894)	Currently using an office-based EHR			Odds of currently using an office-based EHR AOR (95 % CI)¶
		Yes (N=473)	No (N=421)	P-value‡	
Physician sex					
Male	595	308 (51.8)	287 (48.2)	0.33	1.00
Female	299	165 (55.2)	134 (44.8)		0.98 (0.71–1.36)
Birth cohort					
“Silent Generation” (1927–45)	89	30 (33.7)	59 (66.3)	< 0.001	0.44 (0.25–0.76)
“Baby Boomers” (1946–64)	508	258 (50.8)	250 (49.1)		1.00
“Generation X” (1965–81)	297	185 (62.3)	112 (37.7)		1.56 (1.13–2.15)
Years since graduation§	894	20.8±10.3	24.3±10.9	< 0.001	
Type of office practice					
Primary care	610	338 (55.4)	272 (44.6)	0.09	1.00
Medical specialty	245	116 (47.3)	129 (52.7)		0.97 (0.64–1.49)
Surgical specialty	39	19 (48.7)	20 (51.3)		1.52 (0.72–3.18)
Practice setting¶					
Solo	171	64 (37.4)	107 (62.6)	< 0.001	0.45 (0.30–0.69)
Group: single specialty	257	118 (45.9)	139 (54.1)		0.56 (0.36–0.86)
Group: primary care	334	197 (59.0)	137 (41.0)		1.00
Group: multi-specialty	77	71 (92.2)	6 (7.8)		7.53 (3.14–18.07)
Number of patients seen/week¶					
< 45 (bottom quartile)	207	93 (44.9)	114 (55.1)	< 0.001	0.86 (0.58–1.26)
45–90 (middle 50 %)	453	269 (59.4)	184 (40.6)		1.00
> 90 (top quartile)	212	98 (46.2)	114 (53.8)		0.65 (0.45–0.92)
Uses a non-office based EHR					
No	582	293 (50.3)	289 (49.7)	0.04	1.00
Yes	312	180 (57.7)	132 (42.3)		1.33 (0.98–1.82)

*Data source: COPIC November–December 2009 Electronic Health Record survey

†Values reported as number (row %) or mean ± SD

‡All P-values were calculated with the use of Pearson's chi-square test of association to compare proportions and Student's t-test to compare distributions

§From medical school

¶Ns shown in the table do not equal the total number of respondents (894) because respondents with missing data (ranging from 2 % to 6 %) are not shown

¶Adjusted odds ratios (AORs) and 95 % confidence intervals (CIs) were obtained from a multivariable logistic regression model adjusted for gender, birth cohort, type of practice, practice setting, number of patients seen per week, and use of a non-office EHR

non-users. We believe this is the first physician-level, longitudinal study of liability claim rates associated with EHRs in office-based practices.

This study's findings differ from the positive association between EHR use and reduced liability reported in cross-

sectional analysis by Quinn et al.²⁰ In that study (and the similar study by Virapongse et al.¹⁹), the temporal relationship between EHR adoption and claim occurrence was not known, making it problematic to infer causation. Moreover, that study examined only paid claims. Factors that

Table 3. Claims Incidence*

	Non-user to user comparison‡			User pre to post comparison§		
	Non-user	User	P-value	Pre-EHR	Post-EHR	P-value
Population						
Physicians	393	237	NA	163	163	NA
Covered years	6,240	1,355	NA	1,874	930	NA
Claims	540	65	NA	217	47	NA
Per Physician—mean (SD)						
Covered years	15.9 (7.7)	5.7 (2.9)	< 0.001	11.5 (5.9)	5.7 (3.0)	< 0.001
Claims	1.37 (1.68)	0.27 (0.61)	< 0.001	1.33 (1.78)	0.29 (0.65)	< 0.001
Claims per 10 covered years	0.78 (0.90)	0.42 (0.93)	< 0.001	1.15 (1.44)	0.42 (0.95)	< 0.001
Incidence rate ratio (95 % CI)†						
Unadjusted	Reference	0.69 (0.41–1.16)	0.16	Reference	0.51 (0.27–0.95)	0.03
Adjusted	Reference	0.88 (0.52–1.46)	0.61	Reference	0.73 (0.41–1.29)	0.28

*Data source: COPIC November–December 2009 Electronic Health Record survey and medical liability claims data (1982–2009). CI is confidence interval, SD is standard deviation. P-values are from Pearson's chi-square test of association, Student's t-test or negative binomial model as appropriate

†Outcome is claims per 10 covered years. Zero Inflated Negative Binomial Regression, Zero model is adjusted for cohort. Adjusted results control for gender, birth cohort, specialty group, practice setting and use of non-office-based EHR

‡The User cohort reflects the time period after EHR implementation. Physicians with less than three covered years for the specified time cohort were excluded

§Physicians with less than three covered years for both the pre-EHR and post-EHR time period were excluded

Table 4. Categorization of Claims by EHR Sensitivity*

Office-based physicians	Category, n (row %)				P-value
	Total claim abstracts	Plausibly EHR-sensitive	Unlikely EHR-sensitive	Unable to determine	
Claims associated with all survey invitees	1,569	52 (3.3)	1,263 (80.5)	254 (16.2)	} 0.75
Survey non-respondents	1,175	39 (3.3)	941 (80.1)	195 (16.6)	
Survey respondents†	394	13 (3.3)	322 (81.7)	59 (15.0)	
Claim occurred with EHR not in use	333	10 (3.0)	276 (82.9)	47 (14.1)	} 0.37
Claim occurred with EHR in use	61	3 (4.9)	46 (75.4)	12 (19.7)	

*Data source: COPIC medical liability claims with electronic abstracts (2002–2009)

†Among respondents, abstracts with missing year of loss, missing year of adoption, or inconsistent EHR use were dropped from analysis (n=27)

determine whether a claim is paid are different from those that determine whether it is filed, and sometimes turn upon legal tactics more than the facts or allegations in the case. Our study adds to the literature, probing a possible relationship between EHRs and medical liability claims, and indicates that the anticipated positive effects may not yet be evident. This finding is not surprising in light of several factors. Claims are infrequent—physicians in ambulatory specialties have an annual risk less than 5 %, ²⁶ and several years of observing a large cohort are needed to detect trends. Any claim-reduction effect of EHRs would take years to manifest in most settings.

It is also possible that current EHRs are relatively weak in preventing events that give rise to claims. To look for a direct effect, we undertook a systematic approach to classifying medical liability claims according to their likelihood of being prevented by functions typically found in ambulatory EHRs. Notably, we found only a small fraction (3 %) of claims to be plausibly preventable by EHRs, which represents both a limitation of our study and a potentially valuable insight. Repeating this exercise with different reviewers would be worthwhile. Different EHR products or configurations might exhibit different capabilities for preventing EHR-sensitive events, and the types of events that prove to be EHR-sensitive may also evolve with innovations in EHR design and use. Additionally, an indirect, “halo” effect upon practice performance might accompany EHR implementation. Both mechanisms will be important considerations in future evaluations of the impact of EHR-use upon liability claims as well as patient safety.

It is challenging to measure the effects of EHRs on professional liability claims during a period of rapid adoption. Despite the scope of our retrospective sample, we were limited by the number of physicians with long-term EHR experience. Our findings do not statistically exclude the possibility of a decrease in ambulatory claims due to EHR use. The observed estimates (12–27 % risk reduction) are somewhat lower than the effect sizes reported in the Massachusetts study.¹⁹ However, even a 12 % reduction in claims would be meaningful at a population-level, and have policy implications if confirmed. To detect a statistically significant reduction in claims incidence

(assuming a 12 % effect size), we estimate that it would require approximately 9,135 physicians followed longitudinally for at least 3 years post-EHR implementation. This would require a sample size ten times larger than this study.

Our study reflects ambulatory EHR use through 2009 and may not be predictive of effects after that. Our population was on the steep part of the EHR adoption curve, with the majority of EHR users not fully employing their systems (see eTable 2). Accelerated investment in EHRs, including significant Federal stimulus and the concepts of “Meaningful Use” and “EHR Certification” have changed the cost/benefit equation for providers, as well as EHR design and configuration. As EHRs evolve, their repertory of patient safety functions may increase. Offsetting these benefits, instances of patient harm attributable to EHRs may also increase.

This study did not investigate the effects of EHRs on the incidence or severity of adverse events. EHRs might change these without changing claim frequency. Nor did we evaluate claim expenses. These might cautiously be used as a proxy for severity of events, but their interpretation is problematic because legal fees and damage awards are subject to variables unrelated to plaintiff medical costs. The definition of “claim” varies among liability carriers; there may also be significant lag between adverse events and

Table 5. Incidence of (Only) EHR-Sensitive Claims*

	EHR not in use	EHR in use
Population		
Physicians	633	251
Covered years	4,289	1,342
Plausibly EHR-sensitive claims	6	2
Per Physician—mean (standard deviation)		
Covered years	6.8 (1.6)	5.3 (1.9)
Plausibly EHR-sensitive claims†	0.009 (0.10)	0.008 (0.09)
Plausibly EHR-sensitive claims per 10 covered years†	0.01 (0.12)	0.01 (0.11)

*Data source: COPIC November–December 2009 Electronic Health Record survey and medical liability claims data (2002–2009). Physicians with less than three covered years in the specified EHR use cohort were excluded

†Statistical tests (Student’s t-test, Poisson regression model, etc.), although not recommended due to event rarity, yield no association between EHR use and EHR-sensitive claims

claim recognition. Claim incidence may be subject to patient and provider characteristics, such as age, economic status and culture, which this study did not address. Nor did we evaluate events that impacted patients but did not give rise to claims, or “near miss” events with no impact on patients. Both could be valuable sources of data about EHR benefits and risks. Finally, although no COPIC claims through 2009 seemed to originate from EHR use, agencies such as the Agency for Healthcare Research and Quality (AHRQ)²⁷ and the informatics literature¹⁴ have reported errors associated with health information technology.

Our data was strengthened by the ability to track claims for physicians over a significant span of time, having well-defined specialty designations and a representative sample of Colorado physicians. However, Colorado’s rates of liability claims and EHR adoption may differ from other regions. Using December 31st of the year of EHR adoption created some imprecision with respect to claim event dates, and year of adoption was based on physician recall. This study’s findings cannot be assumed to reflect the impact of EHRs in non-office settings, particularly hospitals and integrated delivery systems, where risks, scope of practice and EHR functions differ from those in ambulatory environments.

This was a non-randomized study and selection biases affecting early adoption of an EHR may be related to liability risk. Without an instrumental variable, point estimates may overstate the effect of EHR use on claim rates. Available physician and practice variables were limited. Future studies would benefit from adjusting for patient factors such as age, health status, economic status, education and insurance status in the examination of the impact of EHR use on claim rates.

In summary, in this retrospective cohort study, we could not demonstrate that use of an EHR was associated with a statistically significant effect on medical liability claim rates. Any attempt to calculate premium credits for EHR-use would need to consider the limitations discussed. A definitive study of adequate scope would ideally collect prospective data on EHR adoption for a large number of physicians across several states, to account for regional variances in tort law and litigation practices.

Acknowledgements: All authors had full access to the study data and take responsibility for the integrity of the data and the accuracy of the data analysis. MV, BD and EM conceived the overall study. MV and BD designed the survey and conducted the analysis of EHR-sensitivity. EM and EC guided data collection and performed the epidemiologic and statistical analysis. All authors participated in data interpretation, manuscript preparation and literature review.

Additional Contributions: We are grateful to the following COPIC employees: Jeff Ericson, BA (Business Intelligence Analyst) for compiling data; Alan Lembitz, MD, MMM (Vice President, Patient Safety & Risk Management) and Richard Schirmacher, MS (Manager of Actuarial Services at the time of the study) for help in understanding insurance operations and the underwriting process.

Funding/Support: The work of Dr. Victoroff and Ms. Drury was partly supported by COPIC, which also provided technical and clerical assistance for conducting the physician survey. Dr. Morrato’s effort was partly supported by grant number K12HS019464 from the Agency for Healthcare Research and Quality. The content is solely the responsibility of the authors and does not necessarily represent the official views of the Agency for Healthcare Research and Quality.

Role of the Sponsor: Apart from the above material support, COPIC helped assure that no identifiable information was inappropriately disclosed; otherwise it had no role in the preparation, review or approval of the manuscript.

Conflict of Interest: Dr. Victoroff is President of Recall, Inc., Chief Medical Officer of Parity Computing, Inc., and Chief Medical Officer and a minority shareholder of Lynxare, Inc. He has received compensation from COPIC for consulting services. Within the last 36 months he has received speaker honoraria from the Colorado Medical Society, the American Academy of Family Physicians, the Clinical Orthopedics Society, the Colorado Healthcare Information & Management Systems Society and the Colorado Health Information Management Association. Ms. Drury is President of Pricare, Inc. She has received compensation for consulting services from COPIC, The Doctors Company, Healthcare Information and Management Systems Society, American Health Information Management Association, Professional Association of Healthcare Office Management, Westat, Association of Perioperative Registered Nurses, Healthcare Billing and Management Association and Provider Resources, Inc. Dr. Morrato and Ms. Campagna report no significant conflicts.

Corresponding Author: Michael S. Victoroff, MD; Department of Family Medicine, University of Colorado School of Medicine, 5195 E. Weaver Dr., Centennial, CO 80121-3500, USA (e-mail: michael.victoroff@ucdenver.edu).

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