The double-edged sword of electronic health records: implications for patient disclosure

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Celeste Campos-Castillo[1], Denise L Anthony[2]

ABSTRACT

Objective Electronic health record (EHR) systems are linked to improvements in quality of care, yet also privacy and security risks. Results from research studies are mixed about whether patients withhold personal information from their providers to protect against the perceived EHR privacy and security risks. This study seeks to reconcile the mixed findings by focusing on whether accounting for patients' global ratings of care reveals a relationship between EHR provider-use and patient non-disclosure.

Materials and methods A nationally representative sample from the 2012 Health Information National Trends Survey was analyzed using bivariate and multivariable logit regressions to examine whether global ratings of care suppress the relationship between EHR provider-use and patient non-disclosure.

Results 13% of respondents reported having ever withheld information from a provider because of privacy/security concerns. Bivariate analysis showed that withholding information was unrelated to whether respondents' providers used an EHR. Multivariable analysis showed that accounting for respondents' global ratings of care revealed a positive relationship between having a provider who uses an EHR and withholding information.

Discussion After accounting for global ratings of care, findings suggest that patients may non-disclose to providers to protect against the perceived EHR privacy and security risks. Despite evidence that EHRs inhibit patient disclosure, their advantages for promoting quality of care may outweigh the drawbacks.

Conclusions Clinicians should leverage the EHR's value in quality of care and discuss patients' privacy concerns during clinic visits, while policy makers should consider how to address the real and perceived privacy and security risks of EHRs.

Key words: electronic health records, privacy, consumer surveys, patient-doctor communication, quality of care

BACKGROUND AND SIGNIFICANCE

Despite widespread enthusiasm for and implementation of electronic health record (EHR) systems in the USA, concerns that such systems objectively carry both positive and negative consequences for healthcare—that is, that they are a 'double-edged sword'—have also been common.[1–6] On the positive side, EHRs are expected to improve quality of care, hence the current investment in EHRs through the HITECH Act. With few exceptions,[7,8] recent research has generally found a positive relationship between EHRs and quality of care.[9–13] This enthusiasm, however, has been tempered by the negative side of EHRs, including that they exhibit privacy and security risks.[14,15]

Some research on patient perceptions of these pros and cons of EHRs has considered the consequences for patient–provider communication[11] but not for one crucial aspect of communication: patient disclosure to providers. Patient disclosure is a part of the information gathering for complete documentation of presenting symptoms.[16] From a conceptual standpoint, patient perceptions of EHRs—that they improve quality of care[17–21] and that they entail privacy and security risks[5,11,21–24]—suggest distinct ways that EHRs may shape disclosure. On the one hand, increases in patients' perceptions of the quality of care they receive generally encourages their disclosure of health information to providers.[25,26] On the other hand, whenever patients perceive that the privacy and security of their health information is at risk—such as when patients have stigmatizing health conditions or personal histories—they tend to limit their disclosure to providers as a means of managing such risks.[27–31]

Empirical support for one or the other relationship between EHRs and patient disclosure is somewhat mixed. For example, a recent consumer survey found that those with providers who use an EHR were no more or less likely to express privacy concerns about their health information, and some even stated that EHRs were more secure than paper-based records.[20] Another recent survey finds in a bivariate analysis that some

Correspondence to Dr Celeste Campos-Castillo, Department of Sociology, University of Wisconsin-Milwaukee, 736 Bolton Hall, Milwaukee, WI 53201-0413, USA; E-mail: camposca@uwm.edu

For numbered affiliations see end of article.

patients have withheld information from their providers who use an EHR, but no more than those patients whose providers still use paper records.[32] A related study, however, found that patients who were concerned about the electronic transmission of health information were more likely to withhold information from their provider because of privacy and security concerns.[27] Lastly, another study finds that patients concede that EHRs introduce privacy and security risks, but that the benefits far outweigh these risks.[21]

OBJECTIVE

Given the complexity of the possible relationship between EHRs and patient disclosure, we sought to conduct a multivariable analysis that accounts for the issues more comprehensively. The extant research suggests that a suppressor effect may be contributing to the mixed findings. A suppressor effect can occur when a variable (the 'suppressor') is both negatively associated with the outcome (patient information withholding) and positively associated with the covariate of interest (having a provider who uses an EHR). At first glance, there may appear to be no relationship between the outcome and covariate of interest. Accounting for the suppressor, however, reveals a significant relationship between the two.

We propose that a key aspect of patient care—patients' global assessments of quality—may be such a suppressor in the link between provider-use of an EHR and patient disclosure. Patients' global assessments of quality are strongly correlated with their communication with providers,[33–35] including whether they disclose personal information.[25,26] Moreover, global assessments of quality are also related to provider-use of an EHR.[17–20] We used a recent US survey to elucidate the complexities of the relationship between EHRs and patient disclosure, examining directly whether global quality ratings operate as a suppressor. The survey was conducted during a period in which healthcare providers were rapidly adopting EHR systems as a result of the HITECH Act.[36,37] In addition, we included a comprehensive set of controls for patient demographics, health, and healthcare that are also important covariates, but for which previous studies have not been able to fully account. We consider whether these variables also operate as suppressors in the relationship between EHRs and non-disclosure.

MATERIALS AND METHODS

Sample

We used the two cycles from the 2012 Health Information National Trends Survey (HINTS), a cross-sectional survey by the National Cancer Institute to document how non-institutionalized US adults access and process health information. Complete survey design details are available elsewhere.[38] Briefly, cycle 1 was fielded from October 2011 to February 2012, while cycle 2 was fielded from October 2012 to January 2013. The timeframes correspond to a period of rapid EHR adoption as a result of the HITECH Act.[36,37] The number of respondents in both cycles is 7589, which includes 3959 from cycle 1 and 3630 from cycle 2. A preliminary analysis revealed that our dependent variable, having withheld information from a provider, did not vary by cycle. Accordingly, we aggregated data from both cycles.

Our target sample was respondents with valid responses for: the quality of care they received, whether their providers used an EHR, and whether they had ever withheld information from a provider ($n = 6132$). Our analytic sample ($n = 4753$) includes only respondents from the target sample with complete responses for all additional measures used. Most of the loss of information as we moved from our target to analytic sample was due to missing data on the income measure, where approximately 7.4% of the respondents refused to offer a response. While it is not ideal to lose this proportion of data in a target sample, analyzing only complete cases in this situation is appropriate and even preferred over other options for managing missing data for three reasons.[39] First, the target and analytic samples are comparable with respect to our dependent variable, suggesting that missingness is unrelated to withholding information from a provider. Second, the associations between our three measures of interest—having withheld information from a provider, reporting that a provider offers an EHR, and the global rating of quality of care received—are comparable between the target and analytic samples. For these two reasons, we strongly suspect that analyzing only complete cases does not bias our estimates of the relationships of interest. Of course we cannot be completely certain, but a third reason compelled us to select this method for managing missing data. Analyzing only the complete cases leads to a loss in power to detect statistically significant relationships, making our estimates fairly conservative. Given our large sample size and our aim to uncover a potentially suppressed relationship between EHRs and disclosure, it is preferable to offer conservative estimates.

Measures

To determine who ever withheld information from a provider, we used the item, 'Have you ever kept information from your health care provider because you were concerned about the privacy or security of your medical record?' (Yes/No). Like others using these data,[17] we determined whose provider used an EHR with the item, 'As far as you know, do any of your doctors or other health care providers maintain your medical information in a computerized system?' (Yes/No). Unlike other national surveys,[20] this HINTS survey year did not give respondents the option of indicating that they did not know whether their providers used an EHR. For our purposes of characterizing patient disclosure, perceived—rather than actual—EHR usage is more pertinent because privacy concerns can stem from even the perception.

Respondents' global rating for care was based on the five-point Likert item, 'Overall, how would you rate the quality of health care you received in the last 12 months?' (Poor–Excellent). We coded it so that higher values indicated better quality. Only respondents who reported making a non-emergency room visit in the 12 months before the survey were asked this item.

We included items for respondents' socio-demographics, health, and healthcare. Previous investigations of consumer

privacy opinions did not include these characteristics comprehensively,[23,27] which is unfortunate given their association with withholding information from a provider, having a provider with an EHR, and quality of care ratings.[20,22,36,37,40–43] Sociodemographics included measures of respondents' race/ethnicity, gender, age in years (including a squared term), education level, annual household income, rural code, homeownership status, marital status, and employment status. Health and healthcare items included measures of respondents' self-rated health, anxiety and depression level,[44] number of non-emergency room visits during the 12 months before the survey, self-care self-efficacy, health insurance status, use of a regular provider, perceived importance of EHRs for self, and perceived importance of health information exchange. Self-care self-efficacy was based on the item that asked respondents, 'Overall, how confident are you about your ability to take good care of your health?' (1 = 'Not confident at all,' 5 = 'Very confident'). Perceived importance of EHRs was based on the item that asked 'How important would it be for you to get your own medical information electronically?' (1 = 'Not at all important,' 3 = 'Very important').[45] For importance of health information exchange, the item asked, 'How important would it be for your doctors and other health care providers to share your medical information with each other electronically?' (1 = 'Not at all important,' 3 = 'Very important').

Analyses

To characterize the relationship between EHRs and patient disclosure, we conducted a two-stage analysis using STATA V.12.0. First, we examined bivariate analyses to identify patterns suggestive of suppressor effects, using χ^2 and t tests where appropriate. In our context, this occurs when a control is simultaneously associated with a lower likelihood of having ever withheld information from a provider and a greater likelihood of having a provider who uses an EHR. The previous research we reviewed above suggests that global quality ratings are a candidate for such a pattern. We examined this by stratifying the sample by those who reported ever having withheld information from their provider out of privacy concerns, and then by those who reported that their provider used an EHR. Second, we assessed how the bivariate association between having a provider who uses an EHR and reporting having withheld information from a provider changed when adjusting for all statistical controls described above using nested multivariable binary logit regressions. A positive association indicates that patients with providers who use EHRs are more likely to withhold information than those with providers who do not use EHRs. We also conducted diagnostic tests and auxiliary analyses for the multivariable analysis, and ended the analysis by exploring whether other statistical controls operated as suppressor variables.

RESULTS

Table 1 shows a comparison of sample characteristics by whether respondents have providers who use an EHR. A large proportion (about 92%) of the sample reports having a provider who uses an EHR, in part reflecting that we had to restrict our analysis to just those who reported having made a visit during the year before the survey. Although these are self-reports and exceed rates of office-based EHR systems that meet the HITECH meaningful use standards,[37] the patterns are consistent with studies using objective criteria for determining which patients have access to a provider with an EHR. For example, those who reported having a provider who uses an EHR were more likely to be white patients and have a regular provider.[37,40,42] Relevant for identifying patterns suggesting a suppressor effect, we find that this group of respondents also had significantly higher global ratings of care.[18,19] This satisfies the first condition that global ratings of care must meet in order to fit the suppressor profile, which is being associated with a greater likelihood of having a provider who uses an EHR.

A second condition must be met to fit the profile of a suppressor, which is that this variable must also be associated with a lower likelihood of having ever withheld information from a provider. We examine this second condition in table 2, where we compare the same set of sample characteristics by whether respondents ever withheld information from a provider out of privacy concerns. The patterns provide evidence that the global rating of care is a likely candidate for a suppressor because as shown in table 2, it is associated with a significantly lower likelihood of having ever withheld information from a provider.

Although our focus is on global rating of care, we examined the bivariate patterns for other possible suppressors. The associations of several socio-demographic and health and healthcare characteristics also differ between the two variables as shown in tables 1 and 2. For example, white patients were significantly less likely to report withholding information, yet significantly more likely to report having a provider with an EHR. Similarly, respondents with a regular provider were less likely to withhold information but more likely to have a provider with an EHR. Taken together, these results shown in tables 1 and 2 suggest the importance of moving beyond the simple, bivariate analyses summarized in previous research examining the relationship between EHRs and patient disclosure.[32]

Accordingly, we turned to the multivariable analyses, which are summarized in table 3. Complete model specification details can be found in the online Supplementary appendix. In all three models, respondents with providers who use EHRs, versus those whose providers do not, are more likely to have withheld information from a provider out of privacy concerns. The magnitude of this difference in probability and its statistical significance increases successively from model 1 to model 3, consistent with a suppressor effect. Model 1 shows the unadjusted estimate of the difference in probability, which is non-significant but positive, suggesting that EHR use is associated with a greater probability of non-disclosure. The bivariate analyses showed that several socio-demographic, health, and healthcare characteristics were related to having a provider with an EHR and also to having withheld information from a provider, but sometimes in opposite directions. Model 2 results show that these factors were partially suppressing the

Table 1: Comparison of weighted respondent characteristics in an analytic sample of US adults, by whether their provider uses an electronic health record (EHR) (N = 4753)

Characteristic	Provider uses an EHR		Diff.	p Value
	Yes	No		
% Of analytic sample (n)	91.5 (4345)			
Socio-demographics				
Female, % (n)	54.9 (2687)		9.5	0.089
Race/ethnicity, % (n)				
White	71.3 (2947)		14.6	0.009
Black/African-American	9.7 (608)		−6.9	
Latino/Hispanic	12.0 (495)		−7.2	
Other, non-white	6.6 (274)		−0.5	
Level of education, % (n)				
Less than high school	8.9 (282)		−11.0	0.014
High school	18.9 (782)		−2.2	
Some college	38.0 (1355)		6.0	
College	20.6 (1142)		3.9	
Graduate	13.7 (784)		2.6	
Mean age, years (± SD)	45.7 (± 17.5)		1.7	0.008
Employed, % (n)	58.0 (2388)		0.9	0.849
Annual household income, % (n)				
Less than $20 000	18.6 (798)		−6.8	0.003
$20 000–34 999	14.9 (676)		0.0	
$35 000–49 999	14.4 (641)		3.5	
$50 000–74 999	16.6 (755)		−10.9	
$75 000 or greater	35.5 (1475)		14.2	
Currently married, % (n)	54.8 (2352)		2.6	0.624
Rural, % (n)	16.6 (677)		5.9	0.024
US immigrant, % (n)	10.0 (479)		−12.6	<0.001
Homeowner, % (n)	61.0 (3006)		4.2	0.398
Has health insurance, % (n)	89.4 (3988)		16.4	0.001
Health and healthcare				
Mean self-rated health (± SD)	3.5 (± 0.9)	0.1		0.151
Depression and anxiety status, % (n)				
None	67.0 (2925)	5.4		0.578
Mild	19.9 (867)	−3.5		
Moderate	7.4 (314)	−1.9		
Severe	5.7 (237)	−1.0		

(continued)

Table 1: Continued

Characteristic	Provider uses an EHR		Diff.	p Value
	Yes	No		
Number of non-emergency room visits, % (n)				
1	23.3 (803)	−1.4		0.020
2–4	50.7 (2366)	−10.7		
5–9	15.9 (741)	6.4		
10 or more	10.1 (435)	5.6		
Has regular provider, % (n)	74.7 (3453)	17.7		<0.001
Importance of EHR for self, % (n)				
Not at all	5.8 (274)	−5.9		0.006
Somewhat	21.6 (984)	−5.2		
Very	72.6 (3087)	11.0		
Importance of health information exchange, % (n)				
Not at all	3.4 (171)	−9.1		<0.001
Somewhat	28.0 (1131)	−6.4		
Very	68.4 (3043)	15.3		
Mean self-care efficacy (± SD)	3.8 (± 0.9)	0.1		0.104
Mean global quality of care rating (± SD)	4.0 (± 0.9)	0.3		0.001

Diff. is the point estimate in those reporting 'No' subtracted from the point estimate of those reporting 'Yes.' p Value is the statistical significance of this difference, two-tailed. Results account for the complex survey design.

relationship between EHR use and greater patient non-disclosure. Model 3 introduces global ratings of care and reveals statistically significant support that EHR use is related to a greater likelihood of withholding information from a provider out of privacy concerns. The only change from model 2 to model 3 was the inclusion of the global rating of care, indicating that the multivariable analysis is necessary to move beyond the premature conclusions from bivariate analyses alone, and to account for suppression of the relationship between EHRs and disclosure.

We conducted diagnostic tests to identify multicollinearity issues. None of the correlations between the control measures were above 0.45 and the variance inflation factor scores were all lower than 1.9, all indications that multicollinearity was not an issue.[46] We also examined whether results changed substantially when we excluded controls that were not associated with provider-use of an EHR (table 1) or had not withheld information from a provider (table 2); only marital status fit this criteria. Results were substantively the same when we removed this control from the multivariable analyses. Given that previous research links marital status to health and healthcare outcomes,[47] we decided to keep this control in the analysis.

As we stated earlier, prior research motivated our main focus to examine the degree to which global ratings of care operate as a suppressor in the relationship between provider-use of an EHR and patient non-disclosure. However, given the results from the bivariate analyses, we considered whether any of the other statistical controls also operated as suppressors in the relationship (not shown). For example, race/ethnicity, immigrant status, and age all fit the profile for suppressor candidates. Only immigrant status operated as a suppressor, in that removing this control—while keeping all other controls, including global ratings of care—resulted in a non-significant relationship between provider-use of an EHR and patient non-disclosure. This mirrors the pattern seen in the multivariable analyses summarized in models 2 and 3 in table 3, when we examined whether global ratings of care operated as a suppressor.

DISCUSSION

Discussions of EHRs as a 'double-edged sword' recognize the potential benefits as well as the risks associated with their increasing use in healthcare delivery. However, missing from this literature is how patients' perceptions of the pros and cons of EHRs may affect their behavior during clinical visits.[5,22] In considering patient perceptions that suggest EHRs are a 'double-edged sword'—that is, their potential to improve quality but also increase privacy risks and concerns—our results

Table 2: Comparison of weighted respondent characteristics in an analytic sample of US adults, by reports of having ever withheld information from a provider (N = 4753)

Characteristic	Ever withheld from provider		Diff.	p Value
	Yes	No		
% Of analytic sample (n)	13.0 (618)	87.0 (4135)		
Socio-demographics				
Female, % (n)	52.2 (391)	54.3 (2528)	−2.1	0.497
Race/ethnicity, % (n)				
White	60.9 (353)	71.4 (2804)	−10.5	0.031
Black/African-American	14.7 (102)	9.6 (583)	5.1	
Latino/Hispanic	15.4 (104)	12.2 (471)	3.2	
Other, non-white	8.6 (55)	6.4 (256)	2.2	
Level of education, % (n)				
Less than high school	9.7 (43)	9.8 (293)	−0.1	0.516
High school	20 (87)	18.9 (787)	1.1	
Some college	41 (217)	36.9 (1243)	4.1	
College	16.8 (151)	20.8 (1088)	−4.0	
Graduate	12.4 (120)	13.7 (724)	−1.3	
Mean age, years (± SD)	42.7 (± 14.3)	46.0 (± 17.8)	−3.3	0.008
Employed, % (n)	67.4 (384)	56.5 (2223)	10.9	0.008
Annual household income, % (n)				
Less than $20 000	21.4 (146)	18.9 (756)	2.5	0.505
$20 000–34 999	17.1 (103)	14.6 (644)	2.5	
$35 000–49 999	15.0 (74)	13.9 (616)	1.1	
$50 000–74 999	15.6 (116)	17.9 (730)	−2.3	
$75 000 or greater	31 (179)	34.8 (1389)	−3.8	
Currently married, % (n)	49.4 (282)	55.3 (2278)	−5.9	0.102
Rural, % (n)	13.4 (89)	16.5 (637)	−3.1	0.319
US immigrant, % (n)	17.5 (116)	10.1 (460)	7.4	0.001
Homeowner, % (n)	55.6 (377)	61.4 (2883)	−5.8	0.079
Has health insurance, % (n)	85.8 (542)	88.3 (3798)	−2.5	0.388
Health and healthcare				
Mean self-rated health (± SD)	3.3 (± 0.9)	3.5 (± 0.9)	−0.2	0.046
Depression and anxiety status, % (n)				
None	59.3 (333)	67.6 (2848)	−8.3	0.001
Mild	20.1 (151)	20.1 (802)	0.0	
Moderate	13.0 (73)	6.7 (274)	6.3	
Severe	7.6 (61)	5.6 (209)	2.0	

(continued)

Table 2: Continued

Characteristic	Ever withheld from provider		Diff.	p Value
	Yes	No		
Number of non-emergency room visits, % (n)				
1	25.4 (130)	23.1 (769)	2.3	0.175
2–4	47.1 (321)	52.2 (2283)	−5.1	
5–9	13.8 (99)	15.6 (687)	−1.8	
10 or more	13.6 (68)	9.1 (396)	4.6	
Has regular provider, % (n)	64.7 (435)	74.5 (3290)	−9.8	0.022
Importance of EHR for self, % (n)				
Not at all	7.1 (44)	6.2 (288)	0.9	0.095
Somewhat	16.6 (114)	22.9 (995)	−6.3	
Very	76.3 (460)	71 (2852)	5.3	
Importance of health information exchange, % (n)				
Not at all	6.8 (50)	4.0 (176)	2.8	0.024
Somewhat	32.5 (193)	28.0 (1081)	4.5	
Very	60.7 (375)	68.0 (2878)	−7.3	
Mean self-care efficacy (± SD)	3.7 (± 0.9)	3.9 (± 0.9)	−0.2	0.025
Mean global quality of care rating (± SD)	3.6 (± 1.0)	4.1 (± 0.9)	−0.5	<0.001

Diff. is the point estimate in those reporting 'No' subtracted from the point estimate of those reporting 'Yes.' p Value is the statistical significance of this difference, two-tailed. Results account for the complex survey design.

EHR, electronic health record.

Table 3: Unadjusted and adjusted ORs for having ever withheld information from a provider out of privacy or security concerns in an analytic sample of US adults

	Model 1: unadjusted bivariate association (95% CI)	Model 2: Model 1 +socio-demographics and health and healthcare context (95% CI)	Model 3: Model 2 +global quality of care rating (95% CI)
Provider uses an EHR	1.14 (0.75 to 1.75)	1.50 (0.96 to 2.33)	1.65 (1.04 to 2.63)*

Results account for the complex survey design.

*Statistically significant at $p<0.05$.

EHR, electronic health record.

show that the conflicting sides are connected because they can shape patient disclosure in unexpected ways. A simplified bivariate analysis, and even a multivariable analysis that did not consider quality of care ratings, each suggested that there is no relationship between EHRs and disclosure. Ending the analysis here would have confirmed previous research that also found no relationship.[20,32] However, when we accounted fully for both sides of the EHR's 'double-edged sword' by adjusting for patient quality of care ratings, we found that having a provider with an EHR was associated with a greater likelihood of withholding information because of privacy concerns.

Withholding information from a provider, to be sure, is a relatively rare event. Our findings, as well as those from other studies,[27–29] suggest that most patients willingly share

personal information with providers. Yet, the deleterious effects of incomplete patient histories for the delivery of care and epidemiological reporting necessitate deeper understanding of when these rare events occur.[16] Recall that the text for the survey item used to measure who withheld information included the phrase, 'because you were concerned about the privacy or security of your medical record,' which suggests that withholding is a privacy-protecting behavior. Certain contexts[48] may make privacy concerns salient—such as living in a small, rural setting,[49] or the presence of a stigmatizing health condition[28,29]—and result in privacy-protecting behaviors. In the first quantitative assessment that simultaneously considers the conflicting aspects of EHRs among patients, our findings suggest that perceived EHR usage may elicit non-disclosure to protect privacy. Future research should seek to determine whether this association is because patients are concerned about how the EHR is used during clinical visits, or about more general concerns related to the information security of electronic records, or both. These are important issues, but we unfortunately cannot unpack them with these data.

The survey item we used was a subjective measure about EHR usage, yet characteristics for respondents who reported that their providers used an EHR are similar to those seen in other studies where EHR usage is determined using objective criteria.[37,40,42] This suggests that the subjective measure is reflective of objective circumstances. The findings also suggest that merely the perceived, and not the actual, usage of an EHR may affect patients' withholding information from their providers. The symbolic as well as the actual aspects of EHR technology may need to be addressed to assuage privacy concerns and take full advantage of such systems' potential for improving quality of care.

The multivariable analyses indicated that, in addition to quality of care, patients' immigrant status also operates as a suppressor in the relationship between provider-use of an EHR and patient non-disclosure. After accounting for the fact that US immigrants were more likely to ever withhold information from a provider *and* less likely to report having a provider who uses an EHR, the analysis revealed that provider-use of an EHR increased the likelihood of withholding information. Little research has been conducted illuminating the role of patients' immigrant status in their communication with their providers.[50,51] Our findings suggest that patients' immigrant status may shape whether they rely on non-disclosure as a form of protecting against perceived privacy and security risks, perhaps brought about by language or cultural barriers and concerns over drawing the attention of immigrant officials.[52]

Policy implications

One course of action is to use the positive side of EHRs (improving quality of care) to address the negative (privacy and security concerns). Patient-provider communication has a strong influence on patient ratings of care,[33–35] underscoring a potential bridge for reconciling the conflicting effects. Patients' engagement with their personal health information from an EHR generally improves the quality of patient–provider communication.[11,13] In turn, patient provider–communication is positively related to patient trust in providers.[53] And finally, previous research has shown that trust is vital in decisions to disclose personal information to a provider.[30,54–56]

Patient–provider communication should include explicit conversations regarding EHRs' benefits as well as the privacy and security issues they raise. Many of the privacy and security concerns related to EHRs have to do with unauthorized (and sometimes even the authorized) access and usage of patient information. Policy discussions of the privacy and security of EHRs typically focus on protecting health information via rules, requirements, and system standards,[57,58] and rightly so given evidence of breaches, unauthorized access, and questionable use of data. This research, however, suggests that it is also important for clinicians to consider how EHRs may affect patient disclosure of information, and particularly how this may be shaped by the EHR's presence in the exam room.[59,60] Clinicians should consider talking with patients about their commitment to protecting patient confidentiality as well as their use of EHRs, discussing the benefits to patients and to clinical care, as well as the risks. Similar candor regarding financial incentives generally improves patient–provider relationships.[61,62] Of course, providers are required by federal law to show patients a Notice of Privacy Practices that describes the handling of patient information, but given the superficiality of such notices in general[63] and the findings reported here, it may go a long way for providers to engage directly with patients about their privacy concerns and EHR usage.

Limitations

Our study has several limitations. First, the cross-sectional design as well as the measure of having ever withheld information from a provider limits our ability to infer causal relationships. The question's wording does not permit temporal ordering of the event in relation to covariates or whether information was withheld from the same provider using an EHR. Other research has used measures that are more suitable for drawing causal inferences[32] but has not captured the full complexity of EHRs' conflicting sides as our research does here; our findings should be interpreted in light of its disadvantages and advantages. The dependent measure (ever withheld information) also presents a second limitation because it is self-reported information that may exhibit social desirability bias. Given past research suggesting that most people assume confidentiality in a healthcare setting,[28,29] it may be considered normative to fully disclose information to a provider, leading to under-reports. Working to our advantage is that these data were collected using self-administered surveys, which generally mitigate social desirability concerns,[64,65] whereas previous consumer-based surveys were conducted over the telephone.[20,23]

CONCLUSION

With the rapid adoption of EHR systems, it is important to simultaneously consider patients' perceptions of their conflicting effects: improving quality of care, yet introducing privacy

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and security risks. In the context of patient disclosure, provider use of an EHR is related to non-disclosure. The perception of the technology may elicit non-disclosure as a privacy-protecting behavior. Although the two sides of the EHR are in direct opposition to one another, there may be ways to use the positive side to mitigate the negative side. EHRs are linked with global ratings of care, which may mitigate the detrimental effects of EHRs on patients' withholding information from providers. Using EHRs in ways that improve quality of care while limiting non-disclosure, particularly through patient–provider communication (some of which may include explicit discussion of clinical confidentiality and EHR's privacy and security implications), may offer an important route for achieving the technology's potential.

CONTRIBUTORS

CC-C and DLA designed the study and interpreted the results. CC-C conducted the analysis and drafted the manuscript. DLA critically reviewed and edited the manuscript. CC-C and DLA read and approved the final manuscript.

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COMPETING INTERESTS

None.

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PROVENANCE AND PEER REVIEW

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SUPPLEMENTARY MATERIAL

Supplementary material is available online at http://jamia.oxfordjournals.org/.

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AUTHOR AFFILIATIONS

[1]Department of Sociology, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin, USA
[2]Department of Sociology, Institute for Security, Technology, and Society, Dartmouth College, Hanover, New Hampshire, USA