

What factors influence the use of electronic health records during the first 10 minutes of the clinical encounter?

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Purpose: The use of electronic health records (EHRs) by physicians during the consultation is common and can be problematic. Factors influencing the use of EHRs during clinical encounters include physician and patient characteristics, consultation type as well as spatial organization of the room and type of EHR template. Their relative importance is however not well known. This study aimed to explore to what extent several physician, patient and consultation factors were associated with EHR use during the first 10 minutes of primary care consultations.

Methods: We examined EHR use of 17 residents in 142 videotaped consultations at the Primary Care Division of the Geneva University Hospitals, Switzerland. We conducted univariable and multivariable analyses with patient, physician and consultation variables to predict EHR use: sex and age of the patient; physician's sex, age, postgraduate experience and EHR-use self-perception; and language, type of consultation (new/follow-up) and content of the consultation using the Roter interaction analysis system (RIAS), the main variable being the percentage of utterances in relation to EHR use during the first 10 minutes.

Results: Male physicians (residents) and those with less clinical experience and conducting a new consultation or addressing biomedical content were positively correlated with EHR use (+5.3% for male physicians, $P=0.101$; +0.6% per year of experience, $P=0.021$; +6.0% for new consultation, $P=0.097$; +0.4% per 1% of biomedical content increase; $P=0.018$).

Conclusion: Only a small number of physician, patient and consultation factors appear to have an impact on the use of EHR during primary care consultations, and this impact remains modest. Given the influence of EHR use on physician-patient relationship, further research should explore what other factors are implicated in EHR use and whether they can be changed or improved.

Keywords: computer use, primary care, predicting factors, electronic health record

Introduction

Physicians use electronic health records (EHRs) during 12%–55% of the consultation time, with considerable variability among users and across clinical settings.¹ Although EHRs can improve biomedical data gathering, facilitate sharing of medical information among health care professionals and reduce medical errors,^{1,2} they can also sometimes have a negative impact on physician-patient communication.^{3,4}

Factors influencing the use of EHRs during clinical encounters are commonly divided into four domains: physician, patient, spatial organization of the room and type of EHR template.^{5,6}

Experienced physicians tend to use EHRs less often, while physicians in training tend to increase their use as they gain clinical experience.^{5,7} The more skilled the

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physicians become in using the EHR, the less patients feel the computer interferes with the physician–patient relationship.^{8,9} Similarly, physicians tend to accept the use of EHRs more easily if they had past positive experiences with EHRs and if they perceived benefits from using it.¹⁰ The use of EHRs also varies according to patients' profile and complaints. Encounters with new patients or complex patients require more time for data entry and increase the use of EHRs.¹¹ EHR use tends to decrease when patients talk about psychosocial issues during encounters.^{12,13} Patients' attitudes and interest toward the computer may also impact on physicians' use of EHRs: some patients focus on the physician and ignore the computer, while others consider the computer as a third actor of the consultation.¹⁴ The way the consultation room is organized and the type of EHR template used also influence how and when the EHR is used.¹⁵ There is an increase in shared information when the spatial organization of the room/desk allows a shared visual access to the screen.¹⁶ The EHR design also influences the physician–patient screen sharing.¹⁷ A very structured template and active alerts and reminders tend to disrupt the flow of the consultation and lead to computer-focused encounters.⁶

Finally, the way physicians are paid also plays a role in EHR use. For example, a pay for performance program linked to documentation of data in the EHR or financial incentives for adopting the EHR will encourage its use.¹

These results come from studies conducted in different settings with a variety of research questions.^{1,18} To our knowledge, no study specifically assessed the respective influence of each of these factors on EHR use during primary care encounters. It is important to understand the influence of each of these different factors on EHR use because some studies showed an inverse correlation between the EHR use and a patient-centered behavior during the consultation.^{7,19–22}

The aim of our study was to explore the impact of several physician, patient and consultation characteristics on EHR use during the first 10 minutes of primary care consultations. We focused on the opening and the history taking parts of the consultation because they represent a key moment of the clinical encounter to develop a good initial relationship and to elicit the patient's agenda while collecting medical information.²³

Methods

We conducted secondary analyses of data from a larger study that assessed the impact of a training program on residents' use of the EHR during the clinical encounter.²⁴ It was conducted at the Primary Care Division of the Geneva University

Hospitals, Switzerland. The Primary Care Division has an outpatient clinic providing care to a diverse and vulnerable urban patient population. It serves as a training center for 40 residents who complete their general internal medicine residency training with 1–2 years of ambulatory care before moving to independent practice as primary care physicians.

In all, 17 residents were asked to provide six to eight self-videotaped clinical encounters, 1 year after the previous EHR template (which only allowed access to laboratory and examination results) was replaced with a more complete and problem-oriented EHR template (allowing full documentation of the primary care consultation as well as access to all laboratories, examinations and specialist consultations). They were asked to videotape three to four of their own encounters during a half day 3 weeks before and after the training period. Eligible encounters were those conducted in French or English, without the presence of a third person or interpreter. They asked eligible patients to provide written informed consent. Consultation time varied between 30 and 45 minutes.

Several patient, physician and consultation characteristics thought or known to influence use of EHR were taken into account.

Patients' age and sex were retrieved from their EHRs. Residents filled a self-administered questionnaire that asked for their sex, age, years of clinical experience, self-perceived keyboard skills ("my keyboard skills are sufficient to use the EHR during a consultation" on a 5-point Likert scale) and perceptions of the impact of EHRs on the physician–patient relationship ("EHR use during consultation interferes with the patient–physician relationship" on a 5-point Likert scale). Consultation characteristics and EHR use were identified from the videotapes. In addition to identifying the type (new or follow-up) and language of the consultation (French or English), the Roter interaction analysis system (RIAS) was used to code the content of the consultation (psychosocial, lifestyle, biomedical or therapeutic).²⁵ A coding scheme based on an initial analysis of 15 videotaped encounters and a review of the literature was used to code the EHR use during the first 10 minutes of the clinical encounter.²⁴ A researcher from "Entre les lignes Inc." coded the EHR use linked to the RIAS utterances. In this secondary analysis, use of EHR was defined as the percentage of utterances for which either the keyboard and/or the screen gaze had been used (continuous variable). Utterances included physician and patient talk as well as moments of silence.

Other variables known to influence EHR use were however not included: room/computer spatial arrangement was

not visible on all videotaped encounters; patients were not asked about their perceptions regarding computer use. Finally, only one EHR template was used in this setting.

Intrarater reliability for Roter interaction coding and interrater reliability for computer use coding were good (intraclass correlation coefficient, respectively, 0.97 and 0.91).

In these secondary analyses, linear models were used to investigate the association between EHR use and the following variables: patient's sex and age; physicians' gender, age, postgraduate experience, level of expertise in typing, belief that the computer is a barrier, and belief that the computer has a negative influence; and consultation's characteristics such as new or follow-up, language spoken, and content (psychosocial, lifestyle, biomedical).

All significant variables were included in a multivariable model, and the final multivariable model was chosen with a backward and forward stepwise procedure based on the Akaike information criterion. We used the Shapiro–Wilk *W*-statistic to investigate the departures from normality regarding the residuals of the final multivariable model. All analyses were run on R 2.15.3 (the R Foundation for Statistical Computing) and TIBCO Spotfire S+ 8.1 for Windows (TIBCO Software Inc., Palo Alto, CA, USA).

Results

We analyzed 142 videotaped clinical encounters conducted by 17 residents. Patient, physician and consultation characteristics are given in Table 1.

When considering each factor separately, having less clinical experience and addressing fewer psychosocial and life style issues (and more biomedical issues) were moderately associated with an increased use of the EHR during the clinical encounter. There was also some weak evidence that being male, younger, not believing that the computer has a negative influence on physician–patient relationship and conducting a first consultation were associated with an increased use of the EHR during the clinical encounter (Table 2). However, EHR use was not correlated with physician's self-perceived keyboard skills or the type of language used. The multivariable analysis brought some evidence that being male, having little clinical experience, conducting a new consultation and addressing biomedical content were moderately associated with an increased use of the EHR use during the clinical encounter (Table 2).

Discussion

Our results suggests that physicians' use of the EHR during the first 10 minutes of the consultation is influenced by

Table 1 Patient, physician and consultation characteristics

Patient characteristics	n=134
Median age (range), years	44 (19–80)
Male, n (%)	83 (59)
Physician characteristics	n=17
Median age (range), years	34 (30–53)
Male, n (%)	7 (41)
Median years of postgraduate experience (range)	6 (4–28)
Postgraduate title in primary care (%)	6 (35)
Mean level of expertise in typing (1–5 Likert scale) (SD)	2.65 (1.1)
Beliefs about EHR use – mean (1–5 Likert scale) (SD)	
• Belief that computer is a barrier	3.50 (1.0)
• Belief that computer has a negative influence	3.65 (1.3)
Consultation characteristics	n=142
Type of consultation, n (%)	
• New case	35 (25)
• Follow-up	105 (74)
• Data not available	2 (1)
Language used during the consultation, n (%)	
• French	126 (89)
• English	16 (11)
Content of the first ten minutes of the consultation (number of utterances) n (%)	n=29,011
• Medical and therapeutic	9,475 (33)
• Psychosocial	1,637 (6)
• Lifestyle	967 (3)
• Positive talk ^a	6,208 (21)
• Emotional talk	814 (3)
• Negative talk ^b	11 (0)
• Social talk ^c	367 (1)
• Partnership ^d	5,551 (19)
• Others	492 (2)

Notes: ^aAgreement, approval, give compliment and laughs. ^bDisapproval and criticism. ^cPersonal remarks and social conversation. ^dAsks for opinion, understanding, reassurance, permission and back-channel responses.

Abbreviation: EHR, electronic health record.

physicians' gender and level of clinical experience and the type and content of the consultation. However, statistical associations were only moderate and other factors may be involved.

Contrary to another study conducted among residents, we found that the higher the postgraduate level, the less likely residents were to use the EHR.^{5,7} The fact that more experienced physicians tended to use EHRs less often during the first 10 minutes may reflect physicians' attempts to reduce the potentially negative effect of the computer on the physician–patient relationship as they become more comfortable with history gathering and clinical reasoning skills.⁷ Decreased EHR use when psychosocial issues are addressed has been observed elsewhere and is an encouraging finding because use of computers when patients express psychosocial issues is strongly discouraged by experts in communication skills.^{12,26} As previously reported, EHR use increases with

Table 2 Link between EHR use during the first 10 minutes of the clinical encounter (% of utterances, including silence) and patient, physician and consultation characteristics

Characteristics	Description of the variable % of use of the computer	Value ^a	P	Value	P
		Univariable		Multivariable	Model
Age of patient	Increase if the patient is 1 year older	+0.004% (-0.208% to +0.216%)	0.9708	–	
Sex of patient	Male	30.0% (23.5% to 36.4%)	0.2697	–	
	Female	26.3% (21.4% to 31.3%)		–	
Age of physician (MD), years	Increase if the MD is 1 year older	-0.4899% (-1.0485% to 0.0688%)	0.0850	–	
Sex (MD)	Male	30.0% (25.8% to 34.2%)	0.0864	30.0% (17.0% to 42.9%)	0.1010
	Female	26.3% (21.4% to 31.3%)		24.6% (11.2% to 38.0%)	
Postgraduate experience (MD)	Increase if the MD has one more year of experience	-0.5847% (-1.0950% to 0.0748%)	0.0251	-0.5994% (-1.1078% to 0.0910%)	0.0213
Level of expertise in typing MD (1–5 Likert scale, 1 being poor and 5 excellent)	Increase by 1 on the Likert scale	+1.8909% (-1.3734% to 5.1552%)	0.2534	–	
Belief that computer is a barrier MD (1–5 Likert scale, 1 being do not agree and 5 fully agree)	Increase by 1 on the Likert scale	-1.2811% (-4.5862% to 2.0240%)	0.4439	–	
Belief that computer has a negative influence (1–5 Likert scale, on 1 being do not agree and 5 fully agree)	Increase by 1 on the Likert scale	-2.3081% (-4.8521% to 0.2359%)	0.0749	–	
Type of consultation	New	33.1% (27.0% to 39.3%)	0.0821	24.6% (11.2% to 38.0%)	0.0967
	Follow-up	26.8% (23.1% to 30.5%)		18.6% (6.4% to 30.9%)	
Language spoken during consultation	English	27.1%	0.7164	–	
	French	28.9%		–	
Psychosocial content	Increase by 1% of the content	-0.4007% (-0.7408% to 0.0605%)	0.0214	–	
Lifestyle content	Increase by 1% of the content	-0.1948% (-0.991% to 0.6014%)	0.6289	–	
Psychosocial and lifestyle content	Increase by 1% of the content	-0.3581% (-0.6660% to 0.0503%)	0.0230	–	
Biomedical content	Increase by 1% of the content	0.3774% (0.0695% to 0.6852%)	0.0167	+0.4016% (0.0708% to 0.7323%)	0.0178

Notes: Factors kept in the multivariable model were given in bold. ^aValues of the estimated coefficients are displayed with 95% CIs (in parenthesis). “+” or “–” are used when the variable is continuous.

Abbreviation: MD, medical doctor.

first (as compared to follow-up) consultations and may be explained by the larger amount of new medical information collected during first encounters.¹¹ Rate of EHR use may be even higher with structured EHRs in which entry fields need to be completed.⁶

Although one of the most frequent barriers to EHR use reported by physicians is the lack of keyboard skills, we observed no association between EHR use and residents' self-perceived keyboard skills.²⁷ Similarly, residents' negative self-beliefs about the impact of EHRs on the physician–patient relationship had no impact on their EHR use, despite the fact that physicians' use of EHRs has been shown to vary

according to their expectations and experiences toward computers use.¹⁰ It is known that self-perceptions often do not correlate with observable behaviors.²⁸ It is also possible that the sample size and a 5-point Likert scale did not allow us to capture such changes. Finally, regarding communication, residents' perceptions may have a greater impact on how they use EHRs than on the frequency of use.

Finally, we found no association between EHR use and the language spoken during the consultation. Although these findings must be confirmed in larger studies, given the small number of encounters conducted in a foreign language, they are of interest since we assumed that use of a foreign

language (English) by the physician could have limited EHR use because of an additional cognitive load.²⁹

Our study presents several other limitations. Although we analyzed a high number of consultations, the relatively small number of physicians in our study limits the generalizability of our findings.¹⁸ Generalizability is also limited by the fact that we conducted the study in a single hospital setting. We focused only on the first 10 minutes of the consultation. However, the results were similar when examining the influence of these factors on the entire length of 30 randomly selected consultations, indicating that EHR use did not dramatically change during other parts of the consultation (data not displayed). The fact that participants themselves elected the videotaped encounters and were aware that they were being videotaped may have modified the way they used the EHR. Patient characteristics were limited to age and gender and did not include information about disease complexity and chronicity or patients' perceptions regarding EHR use. Factors such as type of EHR template, spatial arrangement of the consultation room and health care financing may also affect the way doctors use EHRs. Further research should include such factors and allow comparative studies across different health system settings. Physicians' patterns of EHR use (eg, intermittent or continuous typing and position of the body) could also be further explored.

Conclusion

Only a small number of physician, patient and consultation factors appear to have an impact on the use of EHR during primary care consultations, and this impact remains modest. Very few of these identified factors are actually modifiable. Given the influence of EHR use on physician-patient relationship, further research should explore what other factors are implicated in EHR use and whether they can be changed or improved.

Ethics approval and consent to participate

Written ethical approval was granted by the Geneva University Hospital's research ethics committee in March 2013 (No ref 12 - 207). Participation was voluntary, and participants signed an informed consent form.

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Author contributions

All authors contributed toward data analysis, drafting and critically revising the paper and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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