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Provider interaction with the electronic health record: The effects on patient-centered communication in medical encounters

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Abstract

Objective—The computer with the electronic health record (EHR) is an additional ‘interactant’ in the medical consultation, as clinicians must simultaneously or in alternation engage patient and computer to provide medical care. Few studies have examined how clinicians' EHR workflow (e.g., gaze, keyboard activity, and silence) influences the quality of their communication, the patient's involvement in the encounter, and conversational control of the visit.

Methods—Twenty-three primary care providers (PCPs) from USA Veterans Administration (VA) primary care clinics participated in the study. Up to 6 patients per PCP were recruited. The proportion of time PCPs spent gazing at the computer was captured in real time via video-recording. Mouse click/scrolling activity was captured through Morae, a usability software that logs mouse clicks and scrolling activity. Conversational silence was coded as the proportion of time in the visit when PCP and patient were not talking. After the visit, patients completed patient

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satisfaction measures. Trained coders independently viewed videos of the interactions and rated the degree to which PCPs were patient-centered (informative, supportive, partnering) and patients were involved in the consultation. Conversational control was measured as the proportion of time the PCP held the floor compared to the patient.

Results—The final sample included 125 consultations. PCPs who spent more time in the consultation gazing at the computer and whose visits had more conversational silence were rated lower inpatient-centeredness. PCPs controlled more of the talk time in the visits that also had longer periods of mutual silence.

Conclusions—PCPs were rated as having less effective communication when they spent more time looking at the computer and when there was more periods of silence in the consultation. Because PCPs increasingly are using the EHR in their consultations, more research is needed to determine effective ways that they can verbally engage patients while simultaneously managing data in the EHR.

Practice implications—EHR activity consumes an increasing proportion of clinicians' time during consultations. To ensure effective communication with their patients, clinicians may benefit from using communication strategies that maintain the flow of conversation when working with the computer, as well as from learning EHR management skills that prevent extended periods of gaze at computer and long periods of silence. Next-generation EHR design must address better usability and clinical workflow integration, including facilitating patient-clinician communication.

Keywords

Patient centered communication; Electronic medical records; Physician workflow

1. Introduction

With the widespread implementation of electronic health records (EHR), clinicians increasingly are multitasking during medical encounters, as they have to simultaneously interact with both patient and computer to retrieve data, gather information, and make treatment plans. While conventional wisdom has held that use of the computer interferes with effective communication since a clinician's time and effort are taken away from directly interacting with the patient, the empirical evidence is mixed. Compared to paper records, the use of a computer during the visit does create different patterns of clinician–patient verbal and nonverbal communication [1] that may lead clinicians to focus more on information-related tasks and less on psychosocial issues in the encounter [2,3]. Other studies have reported that EHR use can have both positive and negative impacts on physician–patient relationships [3,4], depending in part on the physician's skills in using the computer [1,5,6], the positioning of the computer in the exam room [7,8], how distracted physicians are when using the computer [9], and the structure and data processes of the EHR itself [10].

The goal of this study was to explore what features of primary care providers' (PCP) interaction with the computer influence patients' perceptions of the quality of provider–patient communication. First, eye contact is an important aspect of interpersonal communication in that it signals interest in one's conversational partner and engagement in the discussion [11]. When a clinician spends considerably more time looking at the computer than the patient, that patient may perceive the clinician as distracted or not fully engaged in the conversation. Second, clinicians physically interact with the computer through mouse clicks and key strokes. Patients may view the clinician's tactile ‘conversation’ with the computer as multitasking and not providing the patient with his or her undivided attention. Finally, the cognitive requirements of working with the EHR could take away from cognitive resources needed to carry on a conversation. If this creates a pattern where the clinician alternates between working on the computer and talking to the patient, it could result in more conversational dead space during which neither clinician nor patient is speaking, thus disrupting the flow of the interaction.

On the other hand, patients may perceive the use of EHR as part of the provider's responsibilities and an important source of information at the point of care [3]. Moreover, some clinicians may be quite skilled at multitasking, enabling them to more successfully integrate their interactions with the computer and the patient [12]. Thus, their use of the computer might have positive or at least neutral effects on their communication with patients. Within the context of a USA Veterans Administration (VA) primary care setting, we examined the effects of PCPs' nonverbal interaction with the EHR—looking at the computer, rate of mouse click/scrolling activity, and silence while working on the computer —on observer ratings of the providers' patient-centered communication, patient involvement in the consultation, and provider control of conversation.

2. Method

2.1. Research setting and participants

Twenty-three care providers (PCPs) (21 physicians and 2 nurse practitioners; 74% female) at four VA primary care clinics in the San Diego area were recruited to participate in the project. The VA San Diego primary care clinics use the VA's paperless EHR system called VISTA Computerized Patient Record System (CPRS®). The CPRS includes all provider chart notes, pharmacy data, laboratory data, radiology reports and images, and patient demographic data. It has computerized patient order entry (CPOE), clinical decision support, and basic key word search capability. All participating VA providers have undergone training in CPRS software and use it for clinical care via traditional desktop PC interface.

The study enrolled 125 established patients scheduled for routine follow-up visits, with up to six patients per PCP. Inclusion criteria for patients included the following: 18 years of age or older, must not have a significant communication disability, must be mentally competent to provide informed written consent, have an established relationship with their provider (a minimum of 2 prior visits within a period of 12 months), and have a minimum of 2 primary care clinic visits/year, based on historical clinic data. The study was approved by the UCSD Institutional Review Board.

Patients willing to participate in the study agreed to have their consultations video-recorded and, following the visit, complete a survey consisting of several post-consultation measures, including their satisfaction with their health care [13].

2.2. Nonverbal measures of EHR activity

Provider gaze at the computer was captured through analysis of video recordings of the interaction. Gaze behavior was coded directly from digital video clips by two trained coders using video coding software (Inqscribe®). Time-stamped data for each visit was then exported for aggregate analysis (e.g., average time for each gaze behavior/consultation). Inter-rater reliability was performed via independent double coding of randomly selected 10% of visits. Agreement of gaze coding was measured by the proportion of time in agreement over total visit time and ranged from 0.58 to 0.96.

The MORAE usability software package (techsmith.com) was used to automatically capture discrete mouse click events. These measurements may be directly summarized into indicators of gross EHR activity and were used to create a measure of number of mouse clicks per minute during a visit.

Conversational dead space was measured as the proportion of time in the consultation when neither PCP nor patient was talking (state 0,0). Coders captured the data using a computer-based coding program as follows: a coder listens to the interaction, focuses on one of the participants (e.g., the PCP), and presses the mouse down when that participant talks, releases it when he/she stops speaking, presses it down when he/she speaks again, and so on for the duration of the consultation. The program's output includes a serial string of 1s (talking) and 0s (silence) every tenth of a second. The coder then goes back to the start of the consultation and does the same coding process with the other participant (e.g., the patient). Once this is complete, the two binary strings are merged onto the same timeline. The conversational dead space measure would be the proportion of 0,0 combinations for that consultation. Reliability for the measure in this study was established by recoding 11 consultations. Inter-coder reliability (assessed with intraclass correlation) was .68, indicating satisfactory consistency between the two coders.

2.3. Communication measures

2.3.1. Patient-centered communication and patient involvement ratings—The PCPs' patient-centered communication (PCC) was assessed with a 12-item measure initially developed by Arntson et al. [14] and later adapted by others for use either as a patient self-report [15,16] or as a rating scale for observers of medical encounters [17]. On five-point Likert scales, the respondent rates the extent to which the PCP was informative (e.g., the provider did not fully discuss with the patient what was causing the patient's problem; the provider thoroughly explained everything to the patient), used supportive communication (e.g., the provider showed a genuine interest in the patient's health; the provider seemed to care about the patient's feelings), and engaged in partnership-building (e.g., the provider encouraged the patient to express concerns and worries; the provider asked for the patient's thoughts about his/her health). Because correlations among the three subscales are generally high (>.71) [17] and because each of these scales were measured with the same number of items ($n = 4$), they were summed to create a single measure, PCC.

Patient involvement in the consultation was measured with an adaptation of Lerman's Perceived Involvement in Care Scale [18], which consists of seven items with five-point

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Likert response options. The scale was worded to assess the judgments of third-party raters (e.g., the patient asked the doctor to explain aspects of the condition, treatment, and/or procedures in greater detail; the patient freely expressed concerns and worries).

t?>Seven trained coders, undergraduate research assistants working in a communication research laboratory and blinded to the purpose of the study, independently watched the video recording of the interaction and, once the visit was concluded, completed both communication measures. Each video recording was rated by 2–3 coders. Inter-rater reliability (assessed with intraclass correlation) was .85 and .80 for the PCC and patient involvement measures, respectively. Observer ratings were averaged such that there was one score per interactant per consultation.

2.3.2. Conversational control—The conversational control measure was generated from the vocalization coding system described above that assessed conversational dead space. For this measure, we used vocalization dominance, the ratio of total time during which PCPs talked while patients were silent (state 1,0) divided by the total time PCPs were silent while patients talked (state 0,1) over the course of the interaction. Reliability of the measure was calculated by recoding 11 consultations. The intraclass correlation was .94.

2.4. Data analysis

We assessed three outcome variables: PCC ratings, patient involvement ratings, and ratio of PCP over patient (including companion) talk during the visit, and their associations with patient and PCP characteristics (except patient gender due to small number of females), including PCP's EHR use (total number of mouse clicks, percentage of gaze time at EHR) and percentage of silence time during the visit. To account for PCP's cluster effect, a linear mixed effects model was used. The univariate analysis was performed to study the association between each variable with outcome. Variables found to be significant at $p < 0.15$ were included in the multivariable analysis, and variables with $p < 0.10$ were kept in the final models. Because PCC and patient involvement often have reciprocal influence on each other, each was also added to the final model to assess its effect on the significance of other variables in the model. Finally, a simple random effects model was used to study the association between the patient satisfaction measure and rating of PCP patient-centered communication, rating of patient involvement, and PCP control of the conversation. Normal assumption of residuals in linear mixed effects model was examined using normal probability plot. All analyses were performed using statistical software R [19].

3. Results

3.1. Overview

The final sample consisted of 125 patient visits. Table 1 presents the characteristics for the study sample. The study subjects were primarily men (96.8%, typical of VA clinics), mostly white (64.8%), just over 60 in average age (SD = 13.4, median = 62), and fairly well educated (81.6% had at least some college education or degree). The distribution of the communication measures, patient satisfaction scores, and PCPs' EHR usage are given in Table 2. Patient satisfaction was positively associated with observer ratings of PCPs' PCC (*p*

= 0.0005) but was not related to ratings of patient involvement or the PCP conversational control measure.

3.2. Univariate analysis

Higher percentage of time looking at the EHR ($b = -12.2$, $p = 0.009$) and a higher percentage of silent time ($b = -21.3$, $p = 0.0001$) were significantly associated with lower ratings of PCPs' PCC. Longer visit time ($b = 0.002$, $p = 0.052$) also was significantly associated with more PCC. As expected, patient involvement ($b = 0.38$, $p < 0.0001$) was positively correlated with PCC.

Longer visit time ($b = 0.002$, $p = 0.002$), less percentage of silent time ($b = -17.2$, $p < 0.0001$), and higher patient education (college vs. high school or lower, $b = 3.28$, $p = 0.048$; more than college vs. high school or lower, $b = 4.18$, $p = 0.012$) were significantly related to more patient involvement.

We also found that a higher ratio of PCP over patient talk time was significantly associated with higher percentage of silent time in the consultation ($b = 2.51$, $p = 0.009$) along with a trend for less patient education (more than college vs. high school or lower, $b = -0.66$, $p = 0.072$) to be associated with more PCP control of talk time.

3.3. Multivariable analysis

Multivariable analysis results are given in Table 3. More PCP time spent gazing at the computer ($p < 0.0001$), less visit time ($p = 0.0003$), patients with less than $20,000 income (compared to > $60,000, $p = 0.006$), and higher percentage of silent time ($p < 0.0001$) remained predictive of lower ratings of PCPs' PCC. We also added the patient involvement rating scores to the fitted model and found a trend for patient involvement to correlate with PCC ratings ($b = 0.19$, $p = 0.079$), while results for other variables stayed similar.

Less visit time ($p = 0.002$) and a higher percentage of silent time ($p < 0.0001$) were associated with less patient involvement in the multivariable model. Regarding PCP control of conversational floor time, we found that only percentage of silence time was significantly predictive ($p = 0.01$) of higher ratio of PCP talk over patient talk.

4. Discussion and conclusion

4.1. Discussion

A major inefficiency of many current generation EHRs is the use of WIMP (Windows, Icons, Menus, Pointers) graphical user interfaces (GUI) and the use of menu- and form-based GUIs for data entry. Such systems require clinicians to navigate deeply nested menus and browse through long pull-down lists that are neither filtered nor contextualized. In addition, simple tasks are broken down into individual components requiring multiple points, clicks, and scrolls. Consequently, the usability of current EHR system can have real impact on clinicians' ability to communicate with patients while engaging with technology.

This study was one of the first of its kind to examine whether the ways in which PCPs' nonverbal engagement with the EHR (e.g., gaze, mouse click/keyboard activity, silence) affected the quality of their communication with patients. PCPs were rated by observers as displaying less patient-centered communication when they spent proportionally more time gazing at the computer and when there was more conversational dead space (silence) in the visit. More conversational dead space was also predictive of less patient involvement and more PCP control of the conversational talk time. The findings have important implications for future research and clinical training, particularly with respect to how the EHR can be managed in ways that do not interfere with patient-centered communication.

First, eye contact is an important indicator of a PCP's attentiveness to a patient and involvement in the interaction [20]. When a PCP spends more time looking at the computer, it may disrupt the flow of the conversation, and the PCP may be perceived as distracted, disengaged, and less patient-focused in the consultation [8]. While this may not be directly related to lower patient satisfaction per se, [21] it could affect how involved patients are in discussing their own concerns and needs [22].

However, the potential negative reaction to gaze directed at the computer and away from the patient is likely mitigated by a number of factors. For example, nonverbal engagement with the computer that takes away from a focus on the patient may be particularly important for patients who are new to the PCP. With an established patient-provider relationship or a history of previous visits (which was part of the inclusion criteria in this study), a patient might have previous experiences to draw upon in assessing the quality of a PCP's communication skills. In the absence of previous experiences (i.e., much like the observers used in this study), how that PCP acts and talks during that particular consultation may have a strong impact on how that PCP's communication is perceived. This may be the reason proportion of gaze at computer and conversational dead space were not predictive of patients' satisfaction (data not reported), but was predictive of observer ratings.

In addition, because eye contact during face-to-face conversation is a commonly accepted social norm (at least in the US and Europe), many PCPs may naturally compensate for the lack of gaze and avoid extended periods of silence through other conversational strategies, such as making small talk or providing the patient with accounts and explanations of what they are doing while they are entering or extracting data from the EHR.

The study had several limitations. First, both the patient (n = 125) and PCP (n = 23) samples were relatively small. Also, the patients were mostly male, white, and relatively well educated and the PCPs were disproportionally female (74%). Thus, the sample sizes and demographic distribution of patients and PCPs precluded additional exploration of subgroup differences in the ways clinicians use the EHR and patients react to its use. Second, PCPs in the study used the same EHR, and there may be differences in the ways PCPs interact with other types of EHRs. Third, we examined observers' ratings of communication quality and not the actual patients' perceptions of communication. However, consistent with other studies using analog patients, [23,24] observer ratings of PCC were correlated with a general patient satisfaction measure and, compared to patients' ratings, typically provide responses less skewed toward the positive extreme. Future research should additionally examine the verbal content of these encounters in order to analyze various communication strategies PCPs used while working in the EHR. Finally, when PCP and patient were looking at the computer screen together, we coded this as gaze away from the patient when in fact one could argue patient and PCP were mutually engaged with the same visual object. However, instances of shared screen were quite rare and did not affect the results of the analysis.

4.2. Conclusions

The way PCPs interact with EHRs in exam-room settings may interfere with their efforts to achieve patient-centered communication if the EHR use takes too much visual attention away from the patient and leads to conversational dead space. Because EHR use is common in outpatient consultations, more research is needed to determine how providers can more effectively engage patients verbally while simultaneously using the EHR.

4.3. Practice implications

These findings have important implications for clinician education on how to manage consultations with patients. For example, many patients believe PCP access to the EHR is beneficial and contributes to higher quality of care. However, the PCP must be able to maximize the advantages of having the EHR in the exam room (e.g., accessing information, efficient data entry), while at the same making sure it does not interfere with PCPs' ability to be attentive, informative, and maintain the flow of the conversation. Moreover, the computer could potentially be a facilitator of provider–patient conversation if, for example, information on the screen was shared visually with the patient for purposes of patient education. This suggests that an educational curriculum should include not only the traditional focus on communication skills, but also EHR management skills (e.g., shortcuts, keyboarding skills, sharing computer screen with patient) that will not impede and could even facilitate the interaction with the patient. Finally, next-generation EHR design must address better usability and clinical workflow integration in ways that can facilitate patient–clinician communication.

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Table 1

Patient characteristics.

Age (years)		
Mean (SD)		60.4 (13.4)
Median (range)		62 (25–88)
Gender	*n*	%
Male	121	96.8
Female	4	3.2
Race and ethnicity		
Caucacian	81	64.8
African American	19	15.2
Asian	10	8
Others	15	12
Education		
High school or lower	23	18.4
Some college	48	38.4
College graduate	27	21.6
More than college	27	21.6
Income		
Less than 20,000	31	25.6
20,000–40,000	40	33.1
40,000–60,000	21	17.4
More than 60,000	29	24
Marital status		
Married	74	59.2
Others	51	40.8

Table 2

Physician EHR usage, gaze time at EHR, talk time, communication ratings, and patient satisfaction scores.

	Mean (SD)	Median (range)
Clinical visit workflow		
Visit length (min)	30.7 (11.5)	29.2 (8.68–68.2)
EHR mouse click count	194 (151)	156 (0, 685)
Gaze time at EHR		
Time (min)	12.7 (8.22)	10.1 (1.38, 36.1)
Percentage of time	39.4(16.9)	34.9 (6.8–81.3)
Silence		
Time (min)	9.63 (5.29)	8.2(2.31–27.2)
Percentage of time	31.7 (12.6)	31.8 (12.9–89.1)
Provider over patient or companion talk	1.65 (1.27)	1.42 (0.17–11.4)
Communication ratings		
Patient centered communication	49.4 (7.90)	50.5 (21.5–60)
Patient involvement	27.7 (5.88)	29 (7.5–35)
Patient satisfaction	4.64 (0.39)	4.77 (2.74–5)

Table 3

Multivariable analysis for association between patient centered communication, patient involvement, patient and provider communication.

	Multivariable mixed effects model		
	Coefficients (*b*)	**Standard Error (SD)**	***p*-Value**
Patient center communication			
Gaze time at EHR (percentage)	−17.1	3.60	<0.0001
Visit length	0.003	0.001	0.0003
Income (reference: <20k per year)			
20k–40k	2.42	1.47	0.103
40k–60k	1.64	1.79	0.360
>60k	4.51	1.60	0.006
Silence time (percentage)	−27.7	4.58	<0.0001
Patient involvement			
Visit length	0.002	0.001	0.002
Silence time (percentage)	− 16.4	3.83	<0.0001
Conversational control (provider talk time over patient/companion talk time)			
Silence time (percentage)	2.46	0.94	0.010