

Refereed papers

Communicating about medications during primary care outpatient visits: the role of electronic medical records

Nedal H Arar PhD
Assistant Professor of Medicine, Veterans Evidence-based Research Dissemination Implementation Center/Audie L Murphy Memorial Veterans Hospital and University of Texas Health Science Center at San Antonio, TX, USA

Lonnie Wen PhD
Health Educator, Fizer Pharmaceutical, San Antonio, TX, USA

John McGrath PhD
Associate Professor, Trinity University, San Antonio, TX, USA

Rebecca Steinbach MPH
Social Science Associate, University of Texas Health Science Center, San Antonio, TX, USA

Jacqueline A Pugh MD
Professor of Medicine, Veterans Evidence-based Research Dissemination Implementation Center/Audie L Murphy Memorial Veterans Hospital and University of Texas Health Science Center at San Antonio, USA

ABSTRACT

Objectives To assess the role of electronic medical records (EMR) in facilitating the content and process of patient–provider exchanges about medications during outpatient primary care visits.

Methods Fifty encounters with six physicians using the EMR were videotaped, transcribed and content-analysed by applying conversation analysis and ethnomethodology techniques. The analysis focused on three aspects of medication communication: (1) process of care: practices by patients and physicians to implement medication decisions; (2) themes: medication topics that consistently emerge; and (3) names: ways patients and physicians refer to medications. In-depth analysis of 20 encounters examined the extent to which either or both parties initiated, expanded and concluded medication discussions.

Results On average 21.2 (range: 8–35; SD=7.4) distinct exchanges per encounter were observed. Of those, 33% were related to medication. Of the 350 medication-related exchanges throughout the encounters, 56% were categorised as routine medication discussion such as ordering and/or refilling medications. Mailing issues were the next most common medication-related exchanges (10.6%), followed by partial adherence (8.9%), self-regulation (7.4%), alternative therapy/over-the-counter medication (6.6%), side effects (6%) and formulary issues (4.6%). Patients and providers used three ways to name medications: generic/scientific name (42%); physical description (39.7%) and brand name (18.3%). Forty-one percent of exchanges included initiation by one or both parties but no further discussion of the issue; 42% included initiation and expansion by both parties but not conclusion; only 17% of exchanges contained complete medication exchanges (initiation, expansion and conclusion) by both parties.

Conclusions EMR facilitated content and process of communication regarding medications during outpatient encounters, especially among patients taking multiple medications and patients who used physical descriptions to identify their medications. EMR use stimulated medication exchanges, leading to further expansion about the topic. However, fewer than one-fifth of exchanges ended with clear conclusions by both parties regarding prescribed medication regimens.

Keywords: adherence, electronic medical records, medications, patient–provider communications

Introduction

The electronic medical record (EMR) is an integral part of the clinical information system, and it has considerable promise for improving health care.[1–3] Comprehensive EMR systems allow providers to review patients' medical records, update medication profiles, and order and evaluate laboratory tests.[4] Electronic records are easier to understand and more legible than paper records.[5] Prescriptions can be sent electronically to pharmacists, helping to reduce medical errors associated with handwritten prescriptions.[6] Furthermore, computerised prescribing can have a positive impact on the patients' role in pharmacotherapy risk–benefit decision making and can alert providers to potential prescription problems, including drug allergies and negative drug interactions.[7,8] The use of electronic prescribing has also been shown to reduce costs by increasing generic prescribing and decreasing administrative costs in handling pharmacy-related issues, such as additional phone calls and faxes from pharmacies to physicians.[9]

In addition to the administrative and safety benefits of electronic prescribing, current research suggests that professional use of a comprehensive EMR improves communication between patients and providers during medical encounters. Our conclusions support our previous research that showed the EMR enhances physician–patient communication. It allows patients to participate and become more involved in the medical interview, thus shifting interactions towards patient-centredness.[10] In our previous research, EMR use was associated with increases in patient participation in the medical interview. This study describes the effect of prescription data availability via an EMR on the content of patient–physician communication regarding medications.

Methods

Setting

In 2000, the Veterans Health Administration (VA) system widely implemented a graphical user interface (GUI) for its electronic patient data system (VISTA), called CPRS (Computerised Patient Record System). CPRS pulls data from scheduling, laboratory, radiology, consults and clinic notes into a single integrated patient record. Providers directly input their notes into the system. The information stored in CPRS is accessed via a keyboard and mouse. The pharmacy package allows the provider to enter new prescriptions, refill existing prescriptions, and check on the frequency and timing of patient refill requests; it also prompts when a patient has a potential drug allergy and for potential drug–drug interactions.

Study design

A cross-sectional, observational study examined the content of 50 videotaped internal medicine clinic encounters with six staff physicians videotaped in 2000 at the Audie L Murphy Memorial Veterans Hospital in San Antonio, Texas. Videotaped observations allowed for assessment of the actual form and content of interactions regarding medications. They also provided the opportunity to examine the role of CPRS in facilitating these interactions. This study is not about a comparison between EMRs and paper records regarding communication about medications, but it describes a set of observations about the impact of the EMR on communication.

The medications screen of CPRS shows the patient's active, discontinued, suspended and expired medications within the VA system. It also includes information on dosage, prescribing physician, date prescribed, date of last refill, refill expiration date and number of remaining refills for each medication. Prescribed medications can be picked up in the pharmacy or mailed to the patient's home. For new prescriptions, the doctor must designate how it is to be sent to the patient (by mail order or pick up at local VA pharmacy). Patients can request medication refills by mailing in a refill request or by using the Audiofax telephone system. Refills that are due can be mailed at the patient's request.

Subjects

We recruited staff primary care physicians who had been using CPRS in the examination room since its local implementation. Patients were recruited as part of a convenience sample of all patients attending the clinic on days staff members were videotaping encounters. Patients' demographic characteristics were obtained from their medical records. Physicians' demographic characteristics were collected using a short survey emailed to them after the encounter. All participants (patients and physicians) read and signed a consent form approved by the Institutional Review Board at the University of Texas Health Science Center at San Antonio (UTHSCSA/VA).

Analysis

Direct observations and analysis of the videotaped encounters examined the EMR's role in facilitating both

the content and process of medication information exchange. The encounter tapes were viewed and the typed transcripts were reviewed. All videotapes were replayed as needed to observe patient–physician communication patterns and to document whether patients brought their medication to the encounter.

Content analysis of the videotaped encounters provided in-depth understanding of patient–physician exchanges about medication. The analysis focused on three aspects of medication communication: (1) process of care: practices of patients and physicians to implement decisions concerning medication use; (2) themes: topics that consistently emerge during the encounter; and (3) names: ways in which patients and physicians refer to medications. A distinct exchange that conveyed one main idea was identified as the basic unit of analysis. A distinct exchange begins with initiation of a topic by either the patient or practitioner and continues until a shift in topic occurs. The analysis was based on conversation analysis and ethnomethodology.[11] This method analyses interactions as they naturally occur and identifies emergent components of conversation.[12] In-depth analysis of a subset of 20 encounters of polypharmacy patients was also performed. These patients were taking an average of five medications each and all but three were taking three or more prescriptions. This subset analysis assessed if both parties initiated, expanded and concluded during the discussion (initiation was defined as beginning the discussion; expansion included seeking and providing information; and conclusion consisted of restating the information, providing a solution or expressing understanding of the issue).

For each medication theme (such as self-regulation of medication), an initial matrix was constructed. The rows of the matrix were defined by the observed answers, and a column was created for each participant. The cells consisted of blocks of text, either quotations or summations. Patterns identified in these reviews formed the basis for further classification into 'higher level' matrices, in which various themes were identified. Finally, the initial information obtained from the transcribed encounters was reduced to keywords, summarising the trends and patterns observed in each of the sets.

Videotaped encounters were transcribed and coded using Atlas.ti software (Atlas.ti 4.2, Scientific Software Development, Berlin, Germany). All phases of the content analysis were supervised, checked and evaluated in weekly meetings with the research team in order to assure consistency in coding and classification procedures. Inter-rater reliability was established by validating consistency in coding and classification procedures by having another researcher recode 50% of the case materials and check for discrepancies.[13] Discrepancies were addressed and 92% agreement between raters was achieved.

Herein we quote several exchanges to illustrate medication themes. The content of these exchanges was not modified; only potentially identifying information was omitted to protect subjects' privacy.

Quantitative analysis included frequency distributions and means for participants' age and number of medications. Correlation analysis assessed the relationship between the number of medication exchanges in the encounters and the amount of time physicians spent using the EMR. Correlation between number of patient medications and number of medication-related exchanges was also analysed. Findings are presented as percentages to demonstrate trends and variation in responses. The desired significance level was set at 0.05 for each of the inferential tests. SPSS 12.0 statistical package (SPSS Inc, Chicago, Illinois) was used for quantitative analysis.

Results

Demographics

Most of the patients were male (95%) and had several co-morbidities, such as diabetes, high blood pressure, cardiovascular disease and depression. The mean age of the patients was 64.5 years (range: 40–86; SD=13.4). The mean number of years the patients had been seeing their current providers was 4.8 years (range: 3–5.75; SD=0.74). Twenty-two (44%) patients were Hispanic; 20 (40%) were Caucasian; six (12%) were African American and two (4%) patients identified their ethnic background as 'other'. All six of the staff physicians were European Americans, four were female, and each physician had been in practice at least eight years. Three staff physicians were faculty members at the affiliated medical school.

Encounters

The encounters averaged 22.6 minutes (range: 5–47; SD=8.9) in length, were all follow-up visits and were similar with respect to patients' demographic characteristics such as age, gender and the presence of at least one chronic illness. On average 21.2 (range: 8–35; SD=7.4) distinct exchanges per encounter were observed. Of those, seven (range: 1–15; SD=3.6) exchanges, or 33%, were related to medications. Patients took an average of 4.7 medications concurrently (range: 0–17; SD=3.4). EMR use was significantly associated with polypharmacy: the amount of time spent interacting with the EMR increased with the number of medications prescribed (r=0.534; P=0.000). Six patients (12%) brought their medications to the encounter, while

44 patients (88%) did not. The most common medications mentioned or discussed during the encounters included cardiovascular medication (20%); over-the-counter (OTC) medication (18%) and diabetes medication and supplies (13%).

The role of EMR in facilitating communications regarding process of care

Direct observations and content analysis of the videotaped encounters showed that EMR use facilitated patient–physician communication regarding medication process of care by allowing physicians easy access to checking active and inactive prescriptions and entering patients' new prescriptions and refills. The following case examples illustrate the benefits of EMR use.

Example 1: Medication list [D = Doctor, CG = Care-giver]

CG: OK, what I need to talk . . . about is his medications. I'll wait for [the patient's wife] to straighten them out. She gives him so many medications and vitamins and all that. And then she forgets. She starts fooling around with something else, and yesterday she had to leave, she had an appointment . . . so I just have to wait until she comes back.

D: Well, do you know, um?

CG: I need a list, more than likely, of the medication that he's taking, that way I can fix him up a box.

D: I can give you such a list today.

CG: OK, I'd appreciate it.

D: It may not be everything that she's giving him, because she likes to give him vitamins and supplements. But I can give you a list of what I have him on in this computer.

CG: Important medications, that way I can give it to him every morning, and make sure he takes them.

In Example 1, the physician spoke with the patient's care-giver about the medications he should have been using. Since the patient's wife was undergoing chemotherapy, she had a tendency to forget which medications the patient was to take. The doctor was able to assist by providing the care-giver with a printed medication list retrieved from the EMR. This list included medications prescribed by this doctor as well as other doctors within the VA system. In this instance, the EMR played an important role in helping not only the patient and physician, but also the care-giver.

In another case, the patient lost the prescription issued by his allergist, but the physician was able to retrieve the relevant information from the computer. The EMR improves the continuity of care by enhancing co-ordination between primary care physicians and specialists. It provides a method of communication between different providers by compiling comprehensive lists of medications, labs and consults. In Example 2, the primary care physician was easily able to access reports from the patient's allergist and provide necessary refills. This example represents a primary benefit of the EMR, electronic interconnectivity, which is not available by using paper records alone.

Example 2: Refill orders [D = Doctor, P = Patient]

D: Oh, so you're not on steroids. OK, so you're now on cromolyn, flonase and flovent. So does [the allergist] think you have asthma?

P: No.

D: Cromolyn, flonase and flovent. Let's see now, what do you need?

P: And what should I do? I've lost my prescription.

D: No problem, next time you go down there again, you can just pick it up. It should be on the computer. I'll check and see how many refills [the allergist] gave you on it.

In Example 3, another physician had prescribed an immune suppressant medication, but the patient did not bring the medication to the encounter and could not remember its name. The EMR enabled the physician to quickly verify the correct medication, dosage and prescribing physician. Again, the computer database provided information that typically is unavailable on a paper chart.

Example 3: Medications prescribed by other physicians

D: Now, is it methotrexate or metoclopramide that they started you on? I don't see methotrexate listed as your medication.

P: Metoclopramide, I know it started with an 'M'.

D: Metoclopramide is for your stomach.

P: Yeah, that's for my stomach.

CG: But he has another one that . . .

D: It is just not in the notes. Let me see . . . med check . . .

P: Med check, they don't give me nothing.

D: Imuran, that's what it is, adds imuran, 100 milligrams.

The role of EMR in facilitating communication regarding names of medications

Patients and physicians used three different ways to refer to medications: (1) generic/scientific name appeared in 147 (42%) of exchanges; (2) general description of the medication (for example, reference to medications by their colour or size) appeared in 139 (39.7%) exchanges; and (3) medication brand name appeared in 64 (18.3%) exchanges. When a generic/scientific or brand name was provided, no other description of the medication was necessary. However, when the patient or physician gave a general description of the medication, 11 different patterns were used to illustrate the types of treatment: medication colour; dosage size; when medication should be taken; how medication should be taken; when medication is issued; medication linked to illness; classification of medication; function of medication (physiological process by which it will treat illness); difficulties involved with using medication; reference to other medication; and attempted pronunciation of medication. These general descriptions served as clues and the EMR, with its inventory of drug information, helped accurately identify the medication. As illustrated in Example 3, one patient referred to his medication by using the medication's first letter: 'I know it started with an M'. These patterns were used alone to describe certain medication or in combination with other patterns. For example: 'I am taking the small, blue tablets' or 'the tiny pink tablets that I am taking in the morning'.

Six patients (12%) who brought medications with them to the encounter were able to show their physician the exact type and dosage. The majority of patients (44, 88%) did not have their medications with them and used general descriptions of their medication. In such cases physicians used the patient's EMR to obtain accurate information.

The role of EMR in facilitating communication regarding medication themes

Of the 350 medication-related exchanges, 196 (56%) were categorised as routine medication discussion, such as ordering and/or refilling medications. Mail order issues were the next most common medication-related exchanges (37, 10.6%), followed by partial adherence (31, 8.9%), self-regulation (26, 7.4%), alternative therapy OTC medication (23, 6.6%), side effects (21, 6%) and formulary issues (16, 4.6%). Partial adherence is unintentional non-adherence, such as forgetting a dose. Self-regulation refers to intentional altering of the medication regimen, such as increasing or decreasing the dose or stopping the medication. OTC treatments employ the use of herbs or using other non-prescribed medication. Formulary issues refers to discussion about specific medications that cannot be issued to patients because they are not on the VA formulary. The EMR was not used to enter OTC or alternative therapy (such as saw palmetto and deer antler) used by patients. However, since this project was completed, CPRS has been amended to allow entering of OTC and non-VA prescriptions. The following examples illustrate how EMR use facilitates communication about medication themes.

Example 4: Routine discussion

D: Now you were taking some benadryl for a while at bedtime to help you sleep. Do you still need that?

P: I need all the help I can get to go to sleep. Because when I get in bed it won't be long before that hip starts hurting and I'll need to get up again.

D: OK. I'll renew that. Are you taking the baclofen for the muscle spasms still? Do they help?

P: It doesn't seem to help but I'm taking it. I think.

This example demonstrates a routine discussion during an encounter. The patient's response to the question about benadryl led to a medication renewal and a discussion of another medication, baclofen. In this case, the EMR allowed for immediate renewal of a prescription and access to information regarding other active medications.

Example 5: Pharmacy

P: Now do I pick up medicine today, or do I just put it in there so when I need it?

D: When you need it.

P: It's ordered though?

D: It's a year's supply of the aspirin, and the atenolol. You're all set.

P: OK. Yeah, that's pretty easy, just call in.

Using the EMR, the doctor was able to prescribe the necessary medications to ensure they were available when the patient needed them. While the physician was entering prescriptions into the EMR, the patient asked about pharmacy procedures. In most cases, pharmacy procedures were discussed in conjunction with entering prescriptions.

Mail order issues were discussed in 26 (52%) of the encounters. Physicians addressed two different aspects of mail order issues: placing orders to have

medications sent to patients via mail, and mailing difficulties.

Example 6: Mailing difficulties

D: Did you get any medicines in the mail?

P: No, ma'am.

D: Since you were here last week?

P: Yes, but they say something is wrong in the computers or something.

D: Did you receive any medicines?

P: No, ma'am.

D: Let me check in the computer.

In this example the doctor is able to use the computer to identify the mailing problem without the patient or doctor needing to directly contact the pharmacy.

Example 7: Monitoring adherence

D: Let me look and see where you are in your prescriptions. You last filled it in January and you have three refills left, so you must have been forgetting to take it.

P: Uh?

D: Let me check, 'cause it's lasted from January to July.

P: That's not quite right because they've sent me a refill on several occasions.

D: Ha ha, they said . . .

P: I've been taking that twice a day every day for a long time now.

In Example 7, the physician detects a potential problem with medication adherence. The physician notices that, according to the EMR, the patient has not been refilling medications although the patient claims he/she is receiving medications through the mail. By having easy access to refill information (number of remaining refills and date of last refill), physicians can check medication adherence.

In-depth analysis of 20 patient–provider exchanges regarding medication for polypharmacy patients examined whether both parties initiated, expanded and concluded regarding medication themes. Forty-one percent of exchanges included initiation by one party or initiation by both parties but no further expansion. Forty-two percent included initiation and expansion by both parties but not conclusion. Only 17% of exchanges contained complete medication exchanges (initiation, expansion and conclusion) by both parties. As illustrated in Example 7, use of the EMR can stimulate exchanges about adherence leading to expansion about the topic. However, in most exchanges, patients and providers did not end with clear conclusions. Interchanges that did not lead to conclusion involved discussion about partial adherence, self-regulation and alternative therapy/OTC medication. For example, few exchanges were related to patients' self-regulation such as altering of the medication regimen (increasing or decreasing the dose or stopping the medication). However, these exchanges did not end with discussion about specific conclusions, comments or plans regarding patients' behaviours.

Discussion

Our findings show that the EMR provided important information regarding: (1) the types and number of medications used by patients; (2) new prescription orders; and (3) renewals and refills. The EMR helped clarify and expand discussions about medication, suggesting an important link to improved adherence rates. Effective communication has been shown to enhance patients' adherence to their prescribed regimen(s), which in turn will improve disease outcome.[14] In our study, patients reported use of alternative therapy/OTC medication, although these treatments were not documented in the EMR. The safety and efficacy of using alternative medical therapies remains largely unknown, and advising patients who seek alternative treatments can be a challenge. There were several instances in which the patient brought up alternative medications such as specific vitamins or deer antler, and the physician was not familiar with the product. The EMR can be used to access a linked drug information source and provide information about alternative therapies during the encounter. Another challenge of OTC use is that such medications are not always included in the EMR medication list. Not having all treatments listed in the EMR increases the patient's risk of adverse drug events.[15] In a national survey, 63% to 72% of respondents who had used alternative therapies and had seen a medical doctor in the past year did not disclose at least one type of alternative therapy to their doctor. Sixty percent indicated that they did not tell the doctor because 'the doctor never asked'.[16] The EMR can provide reminders for physicians to enquire about and record alternative therapy/OTC medication use.

Patients used several approaches to describe their medications: generic name, physical description and brand name. Similarly, Kjellgren *et al* found patients referred to their antihypertensive drugs using a range of possibilities including 'the tablet' or 'the medicine', or by brand or generic name.[17] Other ways of referring to a drug included describing the drug's function or effects/side effects. Our study provided examples of

how patients use colour of tablet or capsule, dosage strength, or broad category of medication to communicate to their provider about medications. These findings suggest that some patients do not have an adequate understanding about their current medications. With the EMR, the physician has access to patient pharmacy records and can use the patient's medication list to identify current prescriptions and determine the best possible treatment for each patient. Our results indicate that the EMR is also beneficial when patients are taking multiple medications and are not familiar with their medications. According to Goulding, patients on multiple medications have an increased risk of inappropriate prescribing.[18] The EMR, by providing accurate and complete prescription information, can reduce the risk of inappropriate medication for these patients.

We found that EMR use facilitated the initiation of medication questions and responses that led to a question–response sequence (expansion) during patients' visits. The medical interview is a face-to-face, two-way process that includes: (1) introduction; (2) discussion; and (3) conclusion regarding health topics.[19] When both parties participate in initiation, expansion and conclusion, information exchange occurs, allowing the patient and provider to achieve shared decision making. One study found that doctors are aware that they do not spend adequate time discussing medications, although they recognise it is important.[20] Our study indicates that EMR use encourages medication discussion. Similarly, Makoul and colleagues found that providers using EMRs during visits elicit more medication questions and involvement from their patients than those using paper records.[21] Despite the increased number of questions and responses, our study found that neither patients nor providers presented any clear conclusions regarding plans for improving adherence. In the more complex polypharmacy situations, it is sometimes difficult to find solid evidence to enable a conclusion to be reached. However, the conclusion segment is essential in making health-related decisions before patients leave the clinic.[22] EMR use can be expanded to further improve communication by prompting conclusions about prescribing regimens.

Within the context of primary care physician–patient visits, researchers have documented both patients' low level of communicative participation and the advantage of enhanced patient participation to healthcare outcomes.[23] Making the patient an active partner in both selection and implementation of therapy represents a cornerstone of effective treatment.[24–26] The physician, using information from the EMR, can review with the patient the indications, possible adverse effects, costs and alternatives (including non-drug therapy). The computer's unique capabilities to display cascading levels of detail should be exploited. Time permitting, providers and patients can zoom in on more detailed information and/or zoom out for a summary of key messages. This technology could transform prescribing into shared decision making, as patient and provider negotiate the best therapy via joint review of information in the computer. The takeover of paper records by electronic versions seems more and more unavoidable, and for good reason. Although many practitioners are anxious about new technology with its different challenges, now is the time to emphasise the benefits of the EMR.[27] Compared with paper-based records, paperless records were easier to understand and more legible. Paperless records were significantly more likely to have at least one diagnosis recorded, to record that advice had been given, and, when a referral had been made, were more likely to contain details of the specialty. When a prescription had been issued, paperless records were more likely to specify the drug dose (86.6% v 66.2%, P=0.005). Use of paperless records also aids doctors in recalling patient consultations. During interviews with doctors, those using paperless records were more able than those using paper records to recall advice given to patients.[28,29] In addition, the EMR can provide patients with useful information such as printed medication lists, dosage information, and graphs representing previous and current therapies.[30,31]

Conclusions

Although implementing an EMR in a physician practice or organisation will incur costs, our study points to the important contribution that the EMR makes by means of facilitating medication communication and providing easy access to patients' pharmacy and medical records. We found that the use of the EMR stimulates exchanges about medication adherence leading to expansion about the topic. However, in most exchanges, patients and providers did not end with clear conclusions. Future studies should examine how EMR use can further improve communication by including a special focus on concluding the discussion, providing alternative therapy/OTC medication information, and offering medication information to assist in patient education and shared decision making.

ACKNOWLEDGEMENTS

The research reported here was supported by the Department of Veterans Affairs, Veterans Health Administration, Health Services Research and Development Service (LIP 66-001). Dr Nedal Arar is an investigator in the Veterans Evidence-based Research

Dissemination and Implementation Center (VERDICT), VHA Health Services Research and Development, at the South Texas Veterans Health Care System, Audie L Murphy Division, San Antonio, Texas and Assistant Professor, Department of Medicine, at The University of Texas Health Science Center at San Antonio.

The views expressed in this article are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs.

Dr Arar's, Dr Wen's and Dr Pugh's salaries were supported in part by the Department of Veterans Affairs.

REFERENCES

1 Wagner EH. Chronic disease management: what will it take to improve care for chronic illness? *Effective Clinical Practice* 1998;1(1):2–4.
2 Wagner EH, Austin BT, Davis C, Hindmarsh M, Schaefer J and Bonomi A. Improving chronic illness care: translating evidence into action. *Health Affairs* 2001;20(6):64–78.
3 Institute of Medicine. *Crossing the Quality Chasm: a new health system for the 21st century.* California: National Academy Press, Institute of Medicine, 2001.
4 Sayer GP, McGeechan K, Kemp A *et al.* The General Practice Research Network: the capabilities of an electronic patient management system for longitudinal patient data. *Pharmacoepidemiology and Drug Safety* 2003;12(6):483–9.
5 Bates DW, Leape LL, Cullen DJ *et al.* Effect of computerized physician order entry and a team intervention on prevention of serious medication errors. *Journal of the American Medical Association* 1998;280(15):1311–16.
6 Patel VL, Arocha JF and Kushniruk AW. Patients' and physicians' understanding of health and biomedical concepts: relationship to the design of EMR systems. *Journal of Biomedical Informatics* 2002;35(1):8–16.
7 Schiff GD and Rucker TD. Computerized prescribing: building the electronic infrastructure for better medication usage [see comment]. *Journal of the American Medical Association* 1998;279(13):1024–9.
8 Tamblyn R, Huang A, Perreault R *et al.* The medical office of the 21st century (MOXXI): effectiveness of computerized decision-making support in reducing inappropriate prescribing in primary care. *Canadian Medical Association Journal* 2003;169(6):549–56.
9 Wang SJ, Middleton B, Prosser LA *et al.* A cost–benefit analysis of electronic medical records in primary care. *American Journal of Medicine* 2003;114(5):397–403.
10 Arar N, McGrath J, Rosales J and Pugh J. The role of electronic medical records in improving patient-centered care in outpatient encounters. *Journal of Information Technology in Healthcare* 2004;2(3):187–202.
11 Perakyla A. Two traditions of interaction research. *British Journal of Social Psychology* 2004;43:1–20.
12 Drew P, Chatwin J and Collins S. Conversation analysis: a method for research into interactions between patients and health-care professionals. *Health Expectations* 2001;4(1):58–70.
13 Bernard H. *Research Methods in Cultural Anthropology.* Newbury Park: Sage Publications, 1990.
14 Jenkins L, Britten N, Stevenson F, Barber N and Bradley C. Developing and using quantitative instruments for measuring doctor–patient communication about drugs. *Patient Education and Counselling* 2003;50(3):273–8.
15 Honigman B, Light P, Pulling RM and Bates DW. A computerized method for identifying incidents associated with adverse drug events in outpatients. *International Journal of Medical Informatics* 2001;61(1):21–32.
16 Eisenberg DM, Kessler RC, Van Rompay MI *et al.* Perceptions about complementary therapies relative to conventional therapies among adults who use both: results from a national survey. *Annals of Internal Medicine* 2001;135(5):344–51.
17 Kjellgren K, Svensson S, Ahlner J and Saljo R. Antihypertensive medication in clinical encounters. *International Journal of Cardiology* 1998;64:161–9.
18 Goulding MR. Inappropriate medication prescribing for elderly ambulatory care patients. *Archives of Internal Medicine* 2004;164(3):305–12.
19 Stewart C and Cash W. *Interviewing: principles and practices* (10e). New York: McGraw Hill, 2003.
20 McGrath JM. Physicians' perspectives on communicating prescription drug information. *Qualitative Health Research* 1999;9(6):731–45.
21 Makoul G, Curry RH and Tang PC. The use of electronic medical records: communication patterns in outpatient encounters. *Journal of the American Medical Informatics Association* 2001;8(6):610–15.
22 Meeuwesen L. Sequential analysis of the phasing of the medical interview. *Epidemiologia e Psichiatria Sociale* 2003;12(2):124–9.
23 Robinson JD. An interactional structure of medical activities during acute visits and its implications for patients' participation. *Health Communication* 2003;15(1):27–57.
24 Mullen PD. Compliance becomes concordance. *British Medical Journal* 1997;314:691–2.
25 Agency for Healthcare Policy and Research. *Effective Dissemination of Health and Clinical Information to Consumers.* Washington DC: AHCPR publication 92–0030, 1995.
26 National Council on Patient Information and Education. *Prescription Medicine Compliance: a review of the baseline of knowledge.* Washington DC: NCPIE, 1995.
27 Gillies J and Holt A. Anxious about electronic health records? No need to be. *New Zealand Medical Journal* 2003;116:U604.
28 Hippisley-Cox J, Pringle M, Cater R *et al.* The electronic patient record in primary care – regression or progression? A cross-sectional study. *British Medical Journal* 2003;326:1439–43.
29 Walton R, Gierl C, Yudkin P, Mistry H, Vessey M and Fox J. Evaluation of computer support for prescribing (CAPSULE) using simulated cases. *British Medical Journal* 1997;315:791–5.
30 Adams WG, Mann AM and Bauchner H. Use of an electronic medical record improves the quality of urban pediatric primary care. *Pediatrics* 2003;111(3):626–32.

31 Okkes IM, Groen A, Oskam SK and Lamberts H. Advantages of long observation in episode-oriented electronic patient records in family practice. *Methods of Information in Medicine* 2001;40(3):229–35.

CONFLICTS OF INTEREST

None.

ADDRESS FOR CORRESPONDENCE

Professor Nedal Arar
Assistant Professor, Department of Medicine
VERDICT, a VHA Health Services Research
Center of Excellence
South Texas Veterans Health Care System
University of Texas Health Science Center at
San Antonio
ALMD/South Texas Veterans Health Care System
7400 Merton Minter Blvd
Ambulatory Care 11C6
San Antonio, Texas 78229–4404
USA
Tel: +1 210 567 0075 or +1 210 617 5300 X 6452
Fax: +1 210 567 4423
Email: ararn@uthscsa.edu

Accepted January 2005