

Social impacts of handheld computer information retrieval during physician-patient communication

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Abstract

Given that more and more clinical applications are being developed for physicians to use at the point of care, it is important to investigate the social consequences of handheld computer use. This paper examines physicians' reports of the issues surrounding integrating information retrieval (IR) technology into doctor-patient communication following two studies: a laboratory study and a field study. In the post-laboratory study interviews, we observed a trend where it was more likely for family physicians to report feeling comfortable using a PDA in front of patients, when compared with general internists ($p=.06$). Physicians' explanations for these attitudes centred on quality of care, social barriers, credibility, different applications and the context including the receptiveness of the patient. Physicians who used clinical databases more often were less likely to report feeling comfortable ($p=.036$) than those who used them more often. In the interviews following a field study, 7/10 residents reported using a PDA during clinical encounters, however none reported using them in front of a patient. Differences between expectations and practice, and implications for the design of IR technology at the point of care are discussed.

Key words: Computer-Mediated Communication, Social Interaction, Doctor-Patient Relationship, Social Impacts

1. Introduction

Physicians are common users of mobile computers in the health care environment (Criswell & Parchman, 2002). In fact, many information resources such as note taking and reference resources (e.g., MD everywhere¹), drug reference databases (e.g., ePocrates²), medical calculators (e.g., MedCalc3000³) are being developed specifically for mobile platforms. Given

¹ <http://www.sikhya.com/macromedia/index.html>

² <http://www.epocrates.com/>

³ <http://www.medcalc3000.com/>

PDA usage in the clinical environment and specifically in the social context of doctor-patient interaction, it is important to investigate the consequences of handheld computer use.

The information-retrieval system examined in this study is an evidence-based medicine (EBM) resource. EBM is a practice of medicine that requires the integration of the best available evidence with clinical expertise and the patients' own values (Sackett, Rosenberg, Muir Gray, Haynes, & Richardson, 1996). The best research evidence consists of critically appraised patient-centred medical research on the accuracy and precision of diagnostic tests, the reliability of prognostic markers, and the efficacy and safety of treatments. EBM sources such as Clinical Evidence (CE)⁴ provides a summary of high quality evidence around management options: organizing findings using relative likelihood of treatment benefits, harms, and costs. In summary, high-quality evidence resources summarize and grade the available scientific evidence in order to facilitate shared decision-making between the physician and patient. Use of these evidence resources at the point of care has been shown to influence treatment-related decision making in terms of confirming, modifying and changing decisions (Sackett & Straus, 1998).

The Evidence at the Point of Care (EPoCare) project (Takeshita et al., 2002) is examining how to provide EBM resources on mobile devices in order to meet physicians' information needs at the point of care. The goal is to allow doctors fast and easy access to high quality medical information through handheld computers that can be used in any practice setting: consultations, medical rounds, etc. EPoCare brings together human factors engineers, computer scientists and physicians to collaborate in design and evaluation of the clinical prototypes. The evaluation of the prototypes focuses on effectiveness, efficiency and satisfaction, as per the ISO 9241 International Usability Standard, in terms of human computer interaction and also integration into current physician workflow and social context.

This paper focuses on the discussion of social impacts surrounding use of evidence resources on a handheld computer at the point of care. Post-study interview data from a laboratory study (Lottridge, Chignell, & Straus, 2004) and from a field study (Lottridge, Chignell, Danicic, & Straus, 2004b) are examined.

2. Methods

2.1 Laboratory Study

Forty-seven physicians participated in usability testing of the prototypes using mobile computers. Physicians from three different user groups (with different levels of medical expertise, varying degrees of familiarity with evidence-based resources, and from two different settings: urban and rural) were recruited to participate: internal medicine residents; general internists; family physicians. Participants completed seventy minute test sessions which required that they work through scenarios relevant to their clinical practice using the evidence resources provided (Clinical Evidence⁴ (CE) and Evidence-Based On Call⁵ (EBOC)) to them on the mobile computers. The session began with participants completing a questionnaire that collected demographic data (e.g. age, gender, type of practice, year of medical school graduation) as well

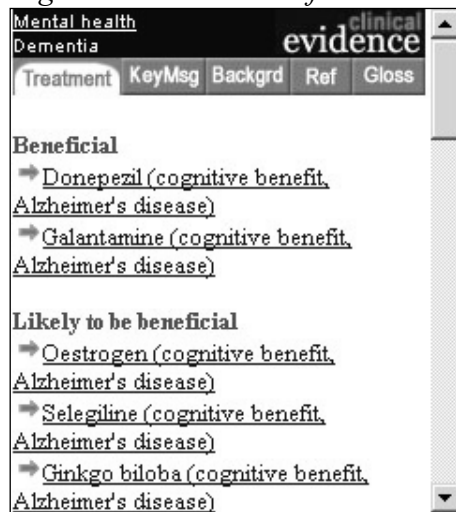
⁴ <http://www.clinicalevidence.com/>

⁵ <http://www.eboncall.org/>

as their exposure to and attitudes towards evidence-based medicine, search engines, internet databases and handheld devices.

Participants were given two scenarios, one per device (one to represent the class of tablet devices and one, the class of PDA devices, in a counterbalanced order. See Figure 1 for the PDA prototype). Each scenario represented a specific patient case and a related question. Participants were encouraged to think-aloud as they moved through the prototype's content looking for information relevant to the scenarios (cf. Ramey, 2004). The facilitator administered a written questionnaire after the participant completed each sub-task (i.e. at pre-determined breakpoints), asking specific questions. For example: asking for the participant's level of agreement in response to a set of statements about the interface and the utility of information. (See Lottridge, Chignell & Straus (2004) for further methodological detail and study results.)

Figure 2. A screenshot from the PDA Implementation of the Clinical Evidence Content.



The usability sessions ended with a set of open-ended questions to probe physicians' attitudes and perceptions of the EBM system and devices (Table 1). This study focuses on the answers to question 4 of Table 1. Physicians' responses to whether they would use a PDA in the presence of a patient were categorized as 'comfortable' or 'uncomfortable'. Statements expressing conditionals were counted as comfortable (see Box 1 for examples). Thus, the uncomfortable category contains only the responses that were clearly and only refusals. Chi-squared analyses were completed to determine differences between user groups for the tabulated responses. SPSS software was used to conduct one-way and two-way analyses of variance (ANOVA) to determine relationships between responses, physician characteristics and background variables. The data from the interviews was transcribed and analysed by the primary author to identify common themes and the analysis was presented to the other authors for review. Discrepancies were resolved through discussion.

Table 1. Sample of questions from exit interview

1. Would you be willing to carry around a device like the tablet or pocketPC during your work day to access this type of information?
2. Please elaborate on the circumstance in which you would or would not carry the device.
3. Would you like a device? If yes, what would you use it for?
4. How would you feel about using handheld device(s) in front of your patient?

2.2 Field Study

In a field study, 11 internal medicine residents were provided with a handheld device for 30 days. The mobile devices provided local access to a drug reference database and an EBM calculator which was designed for quick and easy calculation of common EBM concepts. The Notepad application was included to allow participants local storage of notes. Devices also provided wireless access to two evidence resources, CE and EBOC. In addition, participants had access to PubMed. Wireless connection in the hospital was available in the emergency room and

medical inpatient units. Devices were modified so that the participants could only access the prototype under study. Specifically, the ‘home’, ‘inbox’, ‘contact’ and ‘calendar’ buttons as well as the recording feature were disabled to ensure the devices were used for medical reference purposes only.

12 residents from another hospital served as a control group. They were not provided with a PDA but could use one if they owned one. Both groups continued to receive access to the hospital virtual library available on the internal network. Data collection involved tracking software, questionnaires, and interviews to capture quantitative and qualitative data. The usage logs were analyzed and the verbal data from interviews was transcribed. A post-study focus group was conducted and written notes were taken. One participant in the intervention group was excluded due to incomplete data. Telephone based interviews were conducted after the completion of the study to assess user experience and attitudes towards future device use (Table 2). This study focuses on the third and fourth questions from Table 4. (See Lottridge et al (2004b) for further methodological detail and study results.) Responses were tabulated based on a positive or negative response. Explanations were reviewed to describe behaviour and motivations.

Table 2. Sample of questions from exit interview

Tell me about your experiences with the mobile computer over the last month.
What did you use the device for?
Did you use it during clinical encounters?
Did you use the device in front of a patient?
Would this device be useful to you in practice?

3. Results

3.1 Laboratory Study

Table 3. Summary of Respondent Characteristics in the Sample

Type	n
family physician	17
general internist	17
medical resident	13
Gender	
male	31
female	16
Age	
under 30	8
30-39	12
40-49	13
50-59	11
60 and over	3
Other	
use e- medical databases	35
owned PDAs	27

47 physicians participated in the study. Sample demographics are provided in Table 3.

Physicians’ responses to whether they would use a PDA in the presence of a patient (question 4, Table 1) were categorized as comfortable or uncomfortable (See Box 1). There was a trend towards more family physicians being comfortable using a device in front of a patient compared with general internists (Table 4; $\chi^2[2, N=44]= 5.61, p=.06$).

Table 4. Number of physicians who reported feeling comfortable using a PDA in front of a patient

	Comfortable	Uncomfortable
Family Physicians	16	0
Residents	8	3
General Internists	12	5

Box 1. Selected comments illustrating Uncomfortable/Comfortable categorizations

Uncomfortable: (Includes negative statements)

No don't want to do that
I don't like to
[It] wouldn't look good

Comfortable: (Includes positive and neutral statements)

No problem	[I] wouldn't mind it
I feel comfortable	I'm not embarrassed, but I wouldn't have the time
Good, show the toys	[I am] comfortable to a point

Analysis of the transcripts of the interviews finds several common themes that concerned the physicians when considering use of the PDA including:

- Providing quality care: An advantage was that patients may perceive that they are receiving the best, most up-to-date care.
- Social barriers: Physicians reported that certain social norms discourage using a handheld when with a patient; social conventions dictate that it may be considered rude or impersonal.
- Credibility: being seen referencing material may inspire a lack of confidence
- Applications: related to credibility, certain types of applications are seen as suitable to use in front of patients
- Context: Participants often noted that the decision depends on the patient.

Box 2. Selected comments made during exit interview illustrating themes

Providing quality care:

Patients see you negatively if you look up something in a book, but positively if on a computer
Patients appreciate access to current information, particularly with respect to drugs
[Patients] appreciate that you try to give them the best answer

Social barriers:

[Patients] are used to it, but they might think that I am rude
Fine, but would prefer to use it in [the] office not in front of patients
[It] makes medicine impersonal

Credibility:

You don't want to look at/use a handheld the whole time otherwise lack of confidence
[It] decreases confidence
[It] wouldn't look good. I don't pull out Harrison's to read in front of patients

Applications:

Not to reference data, but ok to write scripts
[I] would do it before or after not in front except for looking up drug dosages and side effects
[It is] ok for scheduling, [but] seems awkward when therapeutic decisions are being made

Context:

[It] depends on how the patient feels
One must be sensitive to the impact on the patient. Must be careful
Most of the time it's ok, some patients think you should have it all in your head

Background variables that were found to be significant predictors of other prototype related behaviours (Lottridge, Chignell, & Straus, 2004) were correlated with self-reported comfort. The only significant association was with usage frequency of electronic medical databases; physicians who used them more frequently were less likely to feel comfortable using a handheld device in front of a patient (one-tailed correlation, $r=-.274$, $p=.036$).

3.2 Field Study

7/10 participants reported using the device during clinical encounters however 0/10 reported using the device in front of patients. Participants reported using the device right before or after consulting with a patient. (Box 3). Explanations for behaviour focused on expectations that the medical consultation was a time for an exchange of information with the patient. Participants felt that additional information needed for clinical decision making should be found or processed outside of the clinical consultation.

Box 3. Selected comments made during field trial post-study interview

Representative example of a participant's answers:

Did you use it during clinical encounters?

Yeah, it was mostly if there was someone that came into the hospital on the type of medication I didn't know of then I would look it up, to find out what class of drug it was.

Did you use the device in front of a patient?

In front of the patient, no.

Sample of other responses:

(...) I never actually used [the PDA] in front of a patient. I don't usually like to look things up right in front of a patient unless it a drug or something. Often you are kind of given information about the patient you are about to see and as walking to see that patient I might have looked a few things up.

Well certainly if I was seeing patients in the ER and when I was looking up things afterwards, writing up a note or that sort of thing. I did, not obviously at the bedside.

No [not with patients], it was just mainly in the nursing station if I was looking up things.

4. Discussion

This study reviewed the interview data for an extensive laboratory user study and a field study involving 47 and 11 physicians, respectively. There was a trend for family physicians to be more likely to feel comfortable using the PDA in the presence of a patient. And those who used medical databases more frequently were less likely to feel comfortable. The main issues determining usage with patients included quality of care, social barriers, credibility, the type of application and the characteristics of the patient. Data from the field study indicated that most participants used the PDA during clinical encounters; however, none used the PDA in front of patients. Interpretations of these results and implications for the design of IR technology at the point of care are discussed in this section.

The type of physicians and the usage frequency of medical database are not independent: in fact, elsewhere (Lottridge, Chignell, & Straus, 2004) clusters of characteristics that vary with physician type are reported. For example, family physicians were found to be less frequent users

of medical databases and online search engines. In the laboratory presented in this paper, it was found that family physicians reported feeling more comfortable with using a PDA in front of their patient. Perhaps those that use medical databases are less comfortable in displaying the need for searches in front of their patients. An alternative interpretation relates to the finding that physicians perceived certain software applications being more appropriate for use in front of patients than others. If family physicians less frequent users of evidence resources, they may find that their other uses of PDAs are easier to integrate into their practice. Lastly, family physicians tend to have long term relationships with their patients. This intimacy may enable them to introduce the device and use more easily into their consultations.

In terms of reflecting on actual usage after the field study, participants indicated that using PDA before and after clinical encounters met their information needs. Due to time constraints, we were unable to solicit in-depth explanations from participants. The usage logging reported elsewhere (Lottridge et al, 2004b) showed that PDA usage was highest outside of regular working hours (9am-5pm), and that residents subscribed to a workflow where information processing is done outside of the clinical consultation. Understanding the present findings with these results implies that residents consciously deferred PDA usage to be outside of doctor-patient interaction.

The discrepancy between expectation of use in the laboratory study and actual use in the field study may indicate unmet or erroneous expectations. Physicians may have expected better performance and usability from the PDA in terms of form factor and applications, and thus decided that it was not appropriate for use in front of a patient. Alternatively, physicians may have expected that they would feel comfortable in a consultation situation, but in actual fact did not feel comfortable enough to use the PDA. Incorporating the use of evidence at the point of care necessitates changes to physicians' standard workflow. It is evident that this type of change will occur slowly over time. Adoption of sophisticated IR technology requires more than its availability (Ash, 1997; Southon, Sauer, & Dampney, 1997). For example, if a physician is used to thinking of and looking up questions at certain points of his or her day, he or she may perceive it as difficult to integrate IR tasks at other times.

The generalizability of these studies is limited by the sample sizes and how representative the participants are when compared to national averages. In that respect, our samples had more internet access (100% as compared to 72%), and similar gender and age distributions (National Physician Survey, 2005). Further, the statistical findings are only borderline significant and need to be confirmed in future research. The strength of this study is its treatment of a sensitive topic with data from both a laboratory study and a field study. Also, our study supports previous research: a qualitative study found a few physicians reported that they did not want to use the PDA in front of patients for fear of looking unknowledgeable, but that those who do used it found acceptance from patients (McAlearney, Schweikhart, & Medow, 2004).

4.1 Implications for Design

The results obtained in this study indicate that that willingness to use PDAs in medical practice is highly dependent on the context. In particular, physicians were concerned about the impact that use of PDAs would have on patient perceptions of their interaction during medical consultation. Thus it seems advisable when introducing PDAs to physicians to include an educational intervention that discusses how to explain the information technology in a positive light.

Compelling reasons for using PDAs include access to the most up-to-date information, and the streamlining of processes and transactions (e.g., viewing electronic medical records, and ordering drugs). In general it seems advisable to minimize the time that physicians use on PDAs while consulting with patients, both to ensure efficiency and also to reduce negative impacts on the physician-patient interaction. Thus relevant information on the PDA should be easily retrievable, concise and easily located on a screen.

Another approach from the emerging discipline of ubiquitous computing is to use the PDA as a remote control that can download information and send it to a large screen situated in the environment (either wirelessly or with a wired connection). By switching between a PDA (personal) screen and a large screen that was also visible by the patient, content can be shared. This would allow physicians to choose which screens to share with patients while preserving feelings of control and expertise. Another consideration is to what extent PDAs should be customized for medical use, particularly with respect to their appearance and form factor. For instance, the use of a different form factor than regular PDAs may increase the perception of medical expertise. Just as the white coat is a symbol of medical expertise and status, a dedicated form factor may elevate the status of information retrieval using a PDA.

5. Conclusion

Barriers to handheld use in front of patients centre on social standards and managing expectations of credibility. The main motivation was the patients' perception of an increase in quality of care when information was retrieved. However, in practice device usage occurred away from the patient's side. These results suggest that handheld device design use should maximize interpersonal focus such as sharing information, while maintaining some technical/lexical distance in order to preserve a sense of expertise.

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