

participate or who were not approached about participating might have had different experiences with the programme than those who participated.

Conclusion and implications

Web based chronic care programmes can shift care processes towards more continuous collaborative relationships between patients and providers. Our work supports further study of web based diabetes programmes that include online communications and open access to the electronic medical record, and contributes to thinking about how to design future programmes. In particular, our study shows the importance of early and candid discussions between patients and providers about what a web based programme can and cannot deliver.

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Doctors' experience with handheld computers in clinical practice: qualitative study

Ann Scheck McAlearney, Sharon B Schweikhart, Mitchell A Medow

Abstract

Objective To examine doctors' perspectives about their experiences with handheld computers in clinical practice.

Design Qualitative study of eight focus groups consisting of doctors with diverse training and practice patterns.

Setting Six practice settings across the United States and two additional focus group sessions held at a national meeting of general internists.

Participants 54 doctors who did or did not use handheld computers.

Results Doctors who used handheld computers in clinical practice seemed generally satisfied with them and reported diverse patterns of use. Users perceived that the devices helped them increase productivity and improve patient care. Barriers to use concerned the device itself and personal and perceptual constraints, with perceptual factors such

as comfort with technology, preference for paper, and the impression that the devices are not easy to use somewhat difficult to overcome. Participants suggested that organisations can help promote handheld computers by providing advice about purchase and usage, training, and user support. Participants expressed concern about reliability and security of the device but were particularly concerned about dependency and over-reliance as a substitute for clinical thinking.

Conclusions Doctors expect handheld computers to become more useful, and most seem interested in leveraging (getting the most value from) their use. Key opportunities with handheld computers included their use as a stepping stone to build doctors' comfort with other information technology and health

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initiatives and providing point of care support to doctors that helps improve patient care.

Introduction

A quarter of US doctors use handheld computers (personal digital assistants), with the proportion predicted to double by 2005.¹ Many uses have been found for these devices in clinical practice, but little research has examined how doctors view their experience with them, especially the effects on patient care. We studied doctors' experiences with and perceptions of handheld computers in various clinical settings.

Methods

Our findings come from doctors' focus groups as one component of a two part qualitative study designed to explore experiences with handheld computers in clinical practice from the perspectives of both organisations and doctors.² We purposely sampled organisations that were reportedly using handheld computers in clinical practice, and we contacted their affiliated doctors to participate in our study.

Focus groups and participants

We held eight focus group sessions lasting 60-90 minutes between April 2002 and September 2003. Six sessions were conducted at a medical centre, a children's hospital, an independent practice association, two community based healthcare systems, and a community hospital. Two sessions were conducted at a meeting of general internists. The sessions were audiotaped, transcribed, and then verified and corrected by one investigator.

Our eight focus groups consisted of 54 doctors. One third of the doctors were women and three quarters were generalists. Nearly half of the participants practised full time, and the remainder were residents or fellows. The groups contained doctors who did or did not use handheld computers, with users representing a variety of levels and patterns of use. One third of participants were affiliated with an academic medical centre and the remainder were affiliated with an independent practice association, community hospital, or children's hospital.

Analyses

We analysed our data using a combination of deductive and inductive methods.³ The investigators read the transcripts, identified broad themes, and discussed emergent findings. By the end of the sixth session no new major themes emerged, indicating near saturation.⁴ We identified categories from the transcripts and constructed major themes.

Results

The use of handheld computers varies widely in clinical practice (box). Clinicians use administrative functions for the development and sharing of lists and databases to keep track of drug formularies, call schedules, and contact details. Specific applications allow patients to be tracked and clinical results to be monitored. The use of administrative functions linked to clinical activities is expanding, with applications such as electronic prescribing and coding attracting

attention because of their potential to increase doctors' productivity.

Participants typically used handheld computers at their own initiation, buying devices based on personal preferences or recommendations. An increasing number of organisations are promoting handheld computers as part of the strategy for clinical information technology, with many academic medical centres purchasing devices for their residents. In one institution, doctors use handheld computers to access patients' electronic records through a browser based application, similar to that in a recent study.⁵ At two organisations we studied, residents use their devices to share patient details between shifts.

Patterns of use and characteristics of handheld computer users

We identified several categories of users (table). Non-users had never used handheld computers or had abandoned them. Niche users included those doctors whose use was restricted to a single application but reported that this limited use was sufficiently valuable such that they would continue use. Routine users had integrated handheld computers into their clinical workflow, using multiple applications on a regular basis. Power users were self described "technophiles" who were eager to showcase their latest device.

Perceived benefits of handheld computers

Users seemed generally satisfied with their handheld computers and perceived many benefits. We anticipated discussion about productivity gains and convenience, but we also heard many doctors describing how they do things differently and "better" with the device. One doctor explained "I don't guess that something is not interacting with warfarin and cross my fingers and hope. That's my biggest thing, I don't guess. Or say I will look that up later and not get to it." Similarly, many participants noted how they "look things up more, medication-wise."

Across all groups, users reported that handheld computer applications often provided complementary benefits, improving both productivity and interactions with patients: "It reminds me to do things that I might forget to do. Not just be at this meeting. But I can get a glance and see that I haven't done the stool occult blood on that patient because they are in front of me." These findings are supported by other studies.^{6,7}

Barriers to use of handheld computers

The two main barriers to using handheld computers were personal issues and the device itself. Issues concerning the device included size, limited memory

Examples of common uses of handheld computers

- Point of care assistance—drug information, clinical guidelines, decision aids, patient education
- Patient information—tracking, clinical results
- Administrative functions—electronic prescribing, coding, tracking schedules
- Research activities—data collection, participant education
- Medical education—lecture notes, presentations, photographs and diagrams

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Patterns and characteristics of users of handheld computers

Category	Non-users	Niche users	Routine users	Power users
Representation in focus groups	17%	20%	50%	13%
Use	Had never used or had used but abandoned	Regular use limited to single application; popular uses include ePocrates, MercuryMD, or scheduling function	Regular use integrated into clinical workflow and daily life; use of multiple applications for different purposes	Constant use characterised by desire to push device to its functional limits; often developed original programs or databases; described frequent upgrades
Usage replaces	Nothing	Some paper references: "It replaces the PDR"	Most paper references: "I no longer carry a calendar or most of my reference books"	All paper: it replaces "everything in my pocket"
User characteristics	Sceptical, uninterested in change, relatively uninterested in new technologies, perceive little or no value in handheld computers	Busy but list oriented, curious but hesitant, low or limited expectations, committed with one application	Willing to experiment gradually, open to new information about handheld computers, can be peer champions, recognise greater potential	Technophiles, peer champions, active promoters, like to show off latest devices and functions
Representative comments	"Paper references and nurses are quicker"; "I don't have time to figure that out"	"I don't have a lot of extra time"; "For ePocrates, it's great"	"I know it can do more"; "I think this is great!"	"It's my life"; "I've always loved technology and gadgets"

and battery life, and speed of data exchange. Many participants expressed frustration, especially with data entry: "You know, with the Palm you are trying to write graffiti. And, you know me, I'm going 'Oh, that's wrong.' I can't remember what is a seven? It's coming out two! I think the data entry is real tough."

Two major personal barriers described by non-users were physical constraints, such as eyesight, and perceptual constraints, including comfort with the device and personal preferences. In contrast, users rarely reported personal barriers and instead described those device features perceived as problematic by non-users as strengths, such as raving about portability rather than complaining about a small screen. Similarly, whereas non-users reported that "these things just have to be easier," routine and power users described the operating systems as "intuitive." A major barrier for non-users expressed in all focus groups was their perception that they did not receive, or expect to receive, enough value from the devices to change their existing practice patterns.

Strategies proposed by doctors to overcome barriers

Participants suggested several ways in which organisations could help to overcome barriers. Doctors who had never used handheld computers noted that advice about which device to use might be sufficient to tip them into a user category: "For people who aren't used to using computers, it's just not worth the time to figure all that stuff out." Niche users wanted specific advice about the appropriateness of applications, and our impression was that this might shift them towards routine use.

Organisations could provide training and retraining to overcome many barriers. Both niche users and routine users were aware that there was more they could do with the device, if only they knew what and how.

Concerns about handheld computers

Concerns raised in early focus groups were purposely explored further in subsequent groups. We categorised concerns into four areas: the device itself, information security, over-reliance, and potential changes to practice.

Doctors' concerns about the device included loss, breakage, and reliability. Less common were concerns

about security. Although doctors expressed concern about secure patient data, they seemed unconvinced that handheld computers represented a greater threat than paper records.

A major concern that emerged in every focus group was dependency, particularly among routine users and power users: "The Palm runs my life—if I lost it! Ugh." Many users also raised the theoretical concern about becoming over-reliant on the device as a "peripheral brain."

Some doctors were concerned about handheld computers changing clinical practice for the worse. Several doctors were concerned that avid users might continuously collect data without furthering patient care. Others were troubled that patients might look negatively upon them for using the devices. A few respondents in each group remarked that they purposely did not use the devices in front of patients, but others were comfortable doing so: "Initially I was afraid that if I had to use a device, they would think I was stupid. But they don't. It doesn't seem that they feel that way. I think I get credit for having a device, which is trendy. So they think I'm smarter." Another group of doctors voiced concern that these devices may become a tool of administration to further constrain their practice, for example, by enforcing guidelines.

Expectations about future use of handheld computers

Most doctors thought that the trend towards incorporating new electronic technologies into medicine would continue. Participants remarked that new doctors were more comfortable with electronic technologies, and this may help promote handheld computer use. Participants in each group said that handheld computers were destined to become critical because of their potential to improve patient safety and the quality of care.

Discussion

Doctors seem to expect handheld computers to become increasingly useful, if not ubiquitous. Organisations can help doctors leverage the use of devices in several ways. Firstly, they can develop applications to facilitate the downloading of material otherwise available on paper. Secondly, they can provide advice, training, and user support and create opportunities for

What is already known on this topic

Little research has examined doctors' perspectives about experience with handheld computers

It is not understood how doctors across practice settings view or value the devices, nor if they have concerns

What this study adds

Doctors who use handheld computers seem satisfied with them and perceive that they enhance patient care; they expect devices to be more useful in the future when input becomes easier and when organisations offer options for wireless connectivity

Concerns about the devices include reliability and dependency

Organisations could promote devices by providing training, user support, and advice to build confidence in the technology and its capabilities; organisations can also leverage use by developing handheld formatted databases and options for mobile access to essential point of care information

As the use of handheld computers in clinical practice is relatively new, and because organisational use of handheld computers varies widely,⁸ we included doctors at various stages in both their own and their organisation's learning about the devices. Our findings are therefore in part influenced by each doctor's place on the learning curve.

Developing strategies to accommodate handheld computers in clinical practice may be advantageous for both institutions and doctors, especially when the devices are used to access clinical information systems, promoting both enhanced safety and improved time efficiency for doctors. When the expected benefits of electronic health records and other electronic applications largely depend on doctors' use of technology, strategies to promote use of such technologies are critical. For many doctors, handheld computers are emerging as a key means to develop familiarity with and to access electronic clinical information. These devices thus may serve as a technology stepping stone for doctors as they face new ehealth initiatives.

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doctors to learn from each other. Finally, they can develop options for mobile access to essential point of care information that can be used on handheld computers.

Our sample was limited to the United States. Although we sought representation from users and non-users of handheld computers, participants were self selecting, and participation was voluntary. It is likely that doctors interested in handheld computers would be more inclined to participate, although our groups did include sceptics and non-users.

One hundred years ago

Messages to medical men

Sir,—In reference to the above question I have been in the habit for some years past of trying to educate the public in my immediate neighbourhood, in the great importance of sending proper messages—especially in urgent cases. This I have tried to do by relating one or more of the following incidents in my ambulance lectures:

1. A little girl called one morning with the message: "Please will you call and see Ma this morning." On taking down the name and address it appeared most convenient to me to make that my last visit, as the message was not urgent. The patient was nearly dead from haemorrhage when I did arrive; but fortunately made a tardy recovery.

2. I received a telegram while at dinner one day to the following effect: "Please come as quickly as possible." I left the table, got a bicycle, and rode my hardest for three miles; arriving breathless and perspiring I met the sender of the wire strolling slowly back from the office, and in response to my rapid inquiries as to what had happened was told that his sister had been ill in bed for a week, and they wanted my opinion before post time—some hours later.

3. One night I answered a ring at my night bell by the usual inquiry down the speaking-tube: "Who's there?"; in response an agitated voice shouted up: "I think he's dead." Failing to get any further information I hastily dressed; but on arriving in the street there was no one about; shortly, however, a policeman strolled up, but he had not seen the messenger. I went back to bed, and learned next day that a child had died suddenly within five minutes' walk of my house. In this case, though, it is doubtful if my services would have been of any avail; and the ambiguous message was due to the natural agitation of the father at the loss of his only son.

These cases—or similar ones which could doubtless be matched in the experience of any man in practice—I have found to considerably impress my audiences at ambulance lectures, and have, I think, had a beneficial effect on the kind of messages I have received of late.—I am etc.,

Percy Sharp.
Newark-on-Trent.

(*BMJ* 1904;i:1407)