Clinical review

Handheld computers

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Handheld computers can save you time and increase your accuracy with clinical facts. The computer part means that you can store all sorts of clinically relevant information, and the handheld part means that you can carry the device wherever your clinical travels take you.

Clinical practice entails a lot of information management. Of course, my seniors at medical school tried their hardest to teach me the medical facts that would guide my future practice. But on the wards they also taught me other things: which local protocol to use; the phone number of other specialists for further management; and which parts of the welfare system would affect clinical outcomes.

And doctors travel a lot. I did not fully understand this until my first few minutes as a doctor: my pager explained to me that I should be heading to another part of the hospital, and it continued to redirect me throughout the day. Such travelling was not just for the inexperienced. My seniors pointed out how much walking they had to do, and their pace put mine to shame. As I began the general practice phase of my rotation, my destinations included not only offices, examination rooms, and committee rooms in the surgery but also patients' homes throughout the surrounding rural area.

It is difficult to escape the feeling that handheld computers were designed with clinical practice in mind. In fact, handheld computers were originally designed for corporate executives: the devices were a replacement for paper organisers as they included diary, address book, "to do" list, and note functions.

Summary points

- Handheld computers are suited to clinical practice because they are small, affordable, and easy to use; can read handwriting; and have a long battery life
- They can run a wide range of medical software
- The devices support clinical teamwork by making it easy to share information with other clinicians' PCs and handheld computers
- Ensuring security of your patients' data is vital and requires some effort
- Make sure your budget includes money for software, textbooks, and hardware expansions

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Main uses

Handheld computers have brought important advantages. With a few taps on the screen, for example, you can convert an appointment for Tuesday's outpatients clinic to an outpatients appointment for every Tuesday of this year (this is much quicker than using a paper diary). Ticking off a task hides it from the handheld computer's screen, leaving a tidy, shorter list of tasks for completion; a house officer's paper list of tasks becomes increasingly messy and illegible as tasks are added, amended, and crossed out. I can scribble a note on my handheld almost as fast as scribbling a note on a piece of paper; finding that note on my handheld computer takes a few seconds, but finding that piece of paper after a year is far more difficult. The device also brings up related notes, tasks, addresses, and appointments.

For many doctors the organiser functions alone have been sufficient justification for buying a handheld computer. Others like using custom designed medical software such as PatientKeeper (www.patientkeeper.com) to keep track of patient records. In the United Kingdom, companies such as EMIS and Torex have handheld computer versions of their software to complement the PC versions (fig 1).

Other software, such as ePocrates Rx (www.epocrates.com), can support prescribing decisions. It is a quick reference of all licensed drugs in the United States and can identify drug interactions.[1]

Liability insurance companies and governments have understood the potential of the ePocrates Rx. MedAmerica Mutual, for example, provided clinicians with devices running the software (www.medamericamutual.com/news/epocrates.html) because it believed that this would reduce clinical errors. Last year, the US government ran a three month trial with ePocrates DocAlert to provide clinicians with updates on bioterrorism (www.healthcare-informatics.com/issues/2003/01_03/ortiz.htm).

In Britain, a handheld computer version of the *BNF* (the British National Formulary) has been developed by the Swedish company MedHand (www.medhand.com) (fig 2). MedHand's software also includes reference textbooks such as the *Oxford Handbook of Clinical Medicine*. American publishers such as Franklin (www.franklin.com/medical), Lippincott

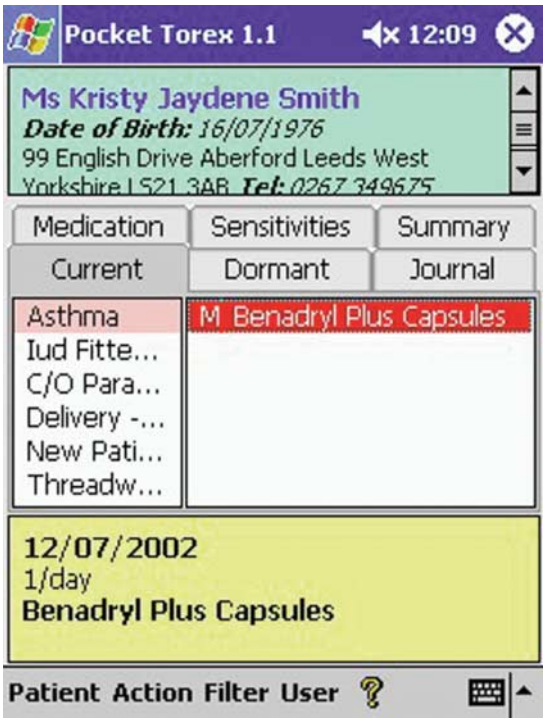

Fig 1 Torex produces software for keeping track of patients' records

Williams & Wilkins (www.lwww.com), and Skyscape (www.skyscape.com) have long provided clinical textbooks for a range of specialties and experience levels, and the BMJ Bookshop sells many of these (www.bmjbookshop.com/shop/Collection_Display.asp?CollectionId=%400000005502).

Furthermore the improving internet connectivity of handheld computers is improving the contribution they can make to evidence based medicine. Last year, for example, the National Library of Medicine customised PubMed (http://certif.nlm.nih.gov:8080/nlm and http://archive.nlm.nih.gov/proj/pmot/pmot.php) for handheld computers. Sites such as the University of Toronto's Centre for Evidence-Based Medicine provide software for evidence based medicine that is customised for handheld computers. The customisation by InfoPOEMs (www.infopoems.com) for handheld computers is well thought out. Its creators provide the POEM ("patient oriented evidence that matters") section in the *BMJ*, and the software also includes Cochrane Database abstracts and diagnostic test calculators.

But the devices really come into their own when you start storing your own local data using databases. At its most basic, a database form looks like a paper form, and a database table stores data in the way a filing cabinet does. Handheld computers allow you to have the right form wherever you need it. Furthermore, software such as HanDBase (www.handbase.com) can speed up completion of forms, for example, by providing a list of ward names. But it is searches that show the biggest advantage of databases—for example, searching a table to identify patients in a particular age range takes only a few seconds.

Team work

Handheld computers have several features that make them suited for clinical team work.

Each device has a cable that can share information with PCs. This sharing is called synchronisation, and it means that an appointment that a secretary adds on a PC with Microsoft Outlook will appear in the clinician's handheld computer's diary. The clinician can also use the device to send and receive emails, dictation notes, and pictures.

Information can also be shared between handheld computers. This sharing is called beaming, and you can do it by lining up your device with a colleague's and tapping the "beam" command. The day before I started as a house officer, the departing house officer beamed to me the hospital's phone numbers. The next day I beamed these to another colleague, and so on.

Software such as HanDBase takes advantage of beaming and synchronisation. You can design a simple database, for example, to keep track of patients' hospital numbers and problems and list the tasks to carry out for each patient. As you begin the day, synchronise your device with those of other members of your team through beaming. As your shift comes to an end, synchronising with the staff of the next shift is fast, accurate, and comprehensive.

Potential problems

Your biggest worry should be security. Like a PC, a handheld computer's default method for storing data is easily accessible, but unlike a PC, theft or loss of the device is also easy.

The easiest way to ensure that sensitive data do not get into the wrong hands is not to store any sensitive data. Keeping a logbook, for example, of all the operations that you carry out is useful for your audits and college membership, but you should not need to store the patients' names and dates of births.

If you must store sensitive data, use software that encrypts the data—for example, eWallet (www.iliumsoft.com) allows safer storage of passwords and details of membership and credit cards. HanDBase also has encryption features that you can switch on. And medical record software, such as Pocket Torex, includes encryption. Insist on it when choosing software for dealing with patients' data.

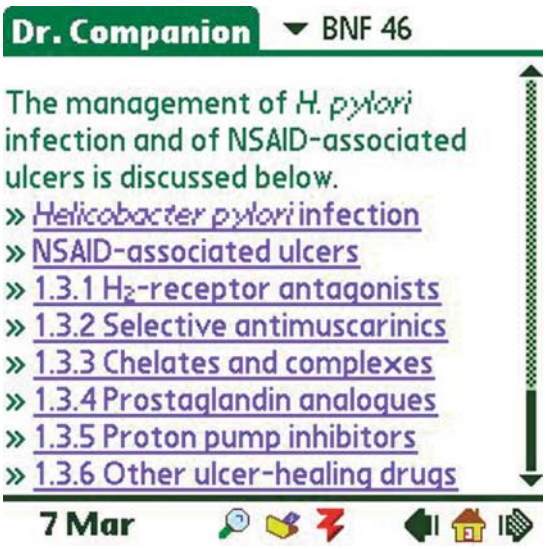

Fig 2 Software for the *BNF* is available for handheld computers

Encryption does not solve all problems, however. Synchronising with a PC, for example, means that a copy of the data is stored on the PC, so you must ensure that the PC is secured. And beaming to a handheld means a copy of the data is stored on someone else's handheld, so that handheld must also be secured, and that person must understand security. Your organisation's computer experts are usually helpful and always necessary in matters of security.

A more subtle problem comes from the assumption that handheld computers are the same as PCs. Instead, you should think of them as two different surgical instruments. Each is good at handling one part of the operation, but not others. Handheld computers are not good, for example, for writing a lengthy patient history (a PC's keyboard is faster). Nor should you use the device for looking at x rays films (a PC's screen gives you the full picture at a high resolution). But a handheld's portability means that you can read the radiologist's report or dictate your response while you are with the patient. And its simplicity means that ordering an investigation is faster than finding the paper form or an available PC. Furthermore the battery life and responsiveness of handhelds are better than with laptops and tablet PCs (similar to laptops but the user can "write" on the screen), and suited to the continuous interruptions and lengthy shifts of clinical practice.

Buying a device

In the United States, for $200 (£113; €169), you can buy a brand new handheld computer that handles all modern clinical software, comes with organiser software, and reads and writes Microsoft Word files. However, you can get by with cheaper or older devices. In Britain, a typical price for a new handheld is £120.

Handheld computers are useful for accessing and storing data and are easy to carry around

Websites for further information

www.doctorsgadgets.com—Complete reviews on the latest handheld computers and medical software

www.pdaconsult.co.uk/bbs/index.php—UK forum for handheld computing in medicine

www.handango.com—Guide and shop for new software. Browse and try before you buy from their secure shop

http://pbrain.hypermart.net—The latest news and views on using your Palm Powered device

www.medicalpocketpc.com—The latest news and views on using your Pocket PC. A small team of US junior doctors keeps the site fresh and entertaining

http://denison.uchsc.edu/evidence_based.html—Includes a good a list of evidence based medicine resources for handheld computers

www.handheldsfordoctors.com/book/text/chapter11.htm—Guide to handheld computer software that is suitable for patients

One thing that you cannot compromise on is the operating system of the device. This determines what software you can use, which in turn determines how useful the device can be to you. Only devices with the Palm Powered or Pocket PC logos can run the major clinical software, so you should not consider other devices even if they are cheaper or have more impressive hardware.

One notable exception is Research In Motion's BlackBerry range of handheld computers (www.blackberry.com). Clinicians like the devices because they provide instant notification of and access to new email messages. IT administrators like the devices because they are easier to administer and secure. However, only a few clinical software applications are available for them (although these do include the excellent Johns Hopkins Antibiotic Guide (http://hopkins-abxguide.org/download_center/learn_to_use.cfm?device=rim&section=pathogen), and clinical software providers are standardising on the Palm Powered and Pocket PC devices.

Some software only runs on one type of device—for example, users of EMIS software need a Palm Powered device, while Torex customers need a Pocket PC. But most of the important software products, such as HanDBase, run equally well on both devices. The *BNF* currently runs on Palm Powered devices made by PalmOne (but not those made by Sony), although a Pocket PC version is planned for release by 2005.

There are several features to look out for in the hardware. In the United States, the $200 devices all have bright colour screens for clarity. The screen's pixels affect how much text you can read at one time. Pocket PCs have 240×320 pixels, while a top of the range Palm Powered device has 480×320 pixels. The RAM represents the amount of information that the device can store at any one time, and Pocket PCs tend to have more RAM than other devices. Finally, some models have a built-in camera or phone, or both. In one ongoing clinical trial, paramedics are using these features to provide advance notification to hospital staff from accident scenes.

You must budget for other spending too for your handheld computer. Textbooks and software can cost a

lot of money—most textbooks in the United States cost at least $60. Textbooks often require an expansion card for storage. Finally, you may find an expandable keyboard useful—this folds to the same pocket size as the handheld but unfolds to match a full size keyboard.

Contributors and sources: The information collected in this article is based on over five years' experience I have had with handheld computers, setting up projects, and working with fellow experts in use of handheld computers. The projects include *Medical Approaches*, a free medical textbook for handheld computers (www.medicalapproaches.org), Project Palm at Cambridge University (www.caret.cam.ac.uk/projects/palm.htm), and working at the Queen Elizabeth Hospital, in King's Lynn. I subsequently wrote the book *Handheld Computers for Doctors* and continue to develop handheld computer solutions (www.handheldsfordoctors.com).

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Competing interests: I own the website handheldsfordoctors.com. It sells my book and handheld computers. I receive a commission from sales through my site, and from sales of my book. I work at the National Library of Medicine, which created the handheld computer versions of PubMed mentioned in this article.

1 Rothschild JM, Lee TH, Bae T, Bates DW. Clinician use of a palmtop drug reference guide. *J Am Med Inform Assoc* 2002;9:223-9.

The clinician's perspective on electronic health records and how they can affect patient care

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Many attempts to get clinicians to use electronic health records have failed, often because of difficulties with data entry.[1–4] Technology should complement and improve clinical care, not impose extra burdens on already overloaded medical staff. The clinical "usability" of electronic records systems is particularly relevant with the recent appointment of service providers to implement the national Integrated Care Record Service for the NHS as usability also affects patient care. I examine important lessons learned from previous attempts to get clinicians to use computers in health care; discuss how clinicians actually work; make recommendations on designing or selecting clinical computer systems; and explore how the use of electronic health records might affect patient care.

Summary points

- Narratives are essential to a patient's episode of illness
- Poor communication is more often detrimental to patients than lack of knowledge
- Computers should enable clinicians to capture narratives easily
- The structure of the patient's record strongly influences the ease of information retrieval

How clinicians work

Use of narratives in clinical reasoning

Patient documentation systems that try to reproduce previously accepted models of clinical reasoning (pattern recognition, algorithms, or hypothetico-deductive models) have achieved limited acceptance. According to Greenhalgh, the medical encounter consists of stories within stories.[5] Kay and Purves maintain that narratives are at the heart of clinical decision making and refers to this concept as "narrative reasoning."[6] They argue that "every patient tells a story (narrative) and clinicians intuitively use narrative devices in relation to the delivery of patient care." The patient is seen as "a page from the book of nature, a text to be read," and the doctor becomes the author of "stories within the medical record." Kay and Purves make a strong case for retaining information in a conceptual framework and maintain that this is best accomplished by means of narratives rather than "reducing the semantic richness and degrading the story to limited codes and weakly connected phrases."

Van Ginneken also states that many computerised medical record systems are rejected by clinicians because they are not based on a story metaphor.[7] Frisse and colleagues state that "using conversations as a central metaphor for handling patients' records reflects work flow in a clinical setting" and that "until recently, shortcomings of medical information systems software, computer-human interfaces, and networks forced upon the healthcare community a depersonalised notion of 'information' centred upon the interaction between the individual and the 'system' rather than upon the interaction of human beings with one another."[8]

Impact of construction of patient record on clinical insight

Berg argues that, to a large extent, compiling a medical record is a sociological process not a cognitive function.[9] Traditionally, the work of clerking a patient was seen as collecting observations, testing diagnostic hypotheses, and reaching treatment decisions by means of logic. Berg maintains, however, that creating the medical record is a "moulding process in which the patient and his situation are reconstructed to render them manageable within existing agency routines." The clinician tries to transform the patient's narrative into an entity which he or she is familiar with and capable of managing. In this process, some aspects of the story are emphasised and others forgotten. The process of creating a patient record changes the clinician's concept of the patient's illness episode. Berg further maintains that failure to appreciate this sociological aspect could par-