

## “Palm reading”: 2. Handheld software for physicians

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### Case 1

Joanna is a third-year medical student who has recently started her clerkship rotation in internal medicine. During her first night on call, her senior resident calls her to the emergency department to assess a 54-year-old man with a history of ulcerative colitis who presents with fatigue, heart palpitations and presyncope. From her lectures in medical school, Joanna recalls the basic features of inflammatory bowel disease. She is anxious because she has never encountered a patient with the condition. Which software resources can she use on her handheld computer to look after her patient?

### Case 2

Dr. Edwards is a family physician with a busy practice in northern Ontario. He is working a shift at the local community hospital's emergency department during a long weekend when an 8-year-old girl is brought in by her parents. She has a high fever, diffuse maculopapular rash and marked lip edema. He is concerned about Kawasaki disease. However, he recognizes that his patient is older than the typical age group affected by this condition and wonders about other possibilities. A consultation with the local pediatrician would be helpful, but she is away on holiday. Dr. Edwards is uncertain about starting therapy for Kawasaki disease. How can he use his handheld computer to help manage his patient?

In an earlier article, we reviewed the hardware options and buying considerations of physicians interested in handheld computers.<sup>1</sup> More than a quarter of Canadian physicians currently use a personal digital assistant (PDA),<sup>2</sup> and it has been estimated that that number will increase to more than half within the next 2 years.<sup>3</sup> Much of the excitement involves the ever-growing library of medical software. With hundreds of titles to choose from, the task of finding the right software can be overwhelming. Although brief overviews of widely used software titles have appeared,<sup>4,6</sup> the aim of this article is to provide an updated and extended summary of some of the more widely used programs, in order to help practitioners find software resources that are most appropriate to their needs. As in our earlier article, this article focuses on software titles available for handheld computers that run the Palm Operating System (OS). Many popular programs discussed in this review are also available for other operating systems, such as Microsoft Pocket PC. Software titles were selected for analysis after reviewing relevant software Web sites and the medical literature.

An article on handheld hardware and operating systems appeared in a previous issue (*CMAJ* 2002;167[7]:775-80).

### Considerations when buying

Most medical programs for the Palm OS are available through the Internet. Some programs can be downloaded free of charge, whereas others must be purchased. Trial versions of many non-freeware programs can be downloaded directly from the Web sites of software manufacturers. Once a trial software licence expires, users are asked to pay a registration fee to continue using the program.

When evaluating trial versions of software, a number of important considerations should be kept in mind. As with any medical information resource, users should carefully scrutinize the quality of the information presented. This assessment should touch upon the credibility of the authors, any potential conflicts of interest, whether the information supplied is current and whether it will be updated to incorporate emerging evidence. Many handheld programs, particularly medical reference software and pharmacopoeias, are adapted versions of well-known medical textbooks. Although these popular titles may be derived from credible sources, they are often abridged versions of their paper-based cousins. It is thus important to determine which content has been omitted and if these omissions reduce the usefulness of the handheld version of the text. The size of a handheld program should also be gauged in relation to the memory storage capacity of your handheld device. If your handheld computer supports expansion memory,<sup>1</sup> programs with large memory requirements that can be stored on and run from expansion memory media are preferable. Although almost all new titles can run from expansion memory, this point should not be taken for granted. Some programs may require a small file to run off the handheld, with most of the program being stored on the memory card. Most e-retailers will provide a contact email address for the publisher should this not be evident from the program's Web site. Because it is cumbersome to scroll through large volumes of text to find relevant information on a handheld, it is important to evaluate the manner in which information is presented. Programs with drop-down menus and reliable search functions can be extremely time saving. Finally, you should consider price, user support and the cost of program updates when determining which titles suit your needs.

### General medical reference programs

Skyscape<sup>7</sup> provides a number of general medical reference titles designed specifically for handhelds (Table 1). Its popular *Griffith's 5-Minute Clinical Consult* is an electronic version

of the famous textbook in which medical topics are neatly divided into hyperlinked subcategories — such as diagnosis, treatment and follow-up — that can easily be navigated with a series of tabs and drop-down menus. A unique feature of Skyscape’s interface is that all of its medical reference applications are linked; as a result, users can quickly navigate between programs to find answers to clinical questions.

Handheldmed<sup>8</sup> is another electronic publisher that provides electronic versions of popular medical textbooks. Although Handheldmed’s electronic books can be searched for specific topics, its interface is not divided into easy-to-navigate subcategories and often requires significant scrolling to find the text of interest.

Like Skyscape and Handheldmed, Franklin Electronic

Publishers<sup>9</sup> offers a number of popular medical titles in electronic book format. Franklin’s electronic books can be downloaded and installed on the handheld or can be ordered as separate removable “plug and play” applications on pre-loaded Springboard modules or MultiMediaCards. The “plug and play” modules are a practical alternative for users with limited available memory storage capacity on their handheld devices.

eMedicine<sup>10</sup> publishes original peer-reviewed synopses of individual topics that are regularly updated and are organized into a 65-specialty medical reference collection. With an expansion memory card, the entire nearly 8000-topic reference collection can be downloaded to a handheld. Alternatively, most of the electronic books are available in

**Table 1: General medical reference programs**

Manufacturer	Major program titles	Advantages	Disadvantages	Cost, US\$
Skyscape www.skyscape.com	<ul style="list-style-type: none"> <li>• 5-Minute Consult Series</li> <li>• Washington Manual of Medical Therapeutics</li> <li>• Ferri’s Guide to the Care of the Medical Patient</li> <li>• The Harriet Lane Handbook of Pediatrics</li> <li>• PocketMedicine Series</li> <li>• Dorland’s Medical Dictionary</li> </ul>	<ul style="list-style-type: none"> <li>• Information is organized by table of contents and alphabetical index</li> <li>• All Skyscape programs are linked</li> <li>• Programs can be run from expansion memory card</li> </ul>	<ul style="list-style-type: none"> <li>• Updates must be purchased after 1 year</li> <li>• Some programs contain italicized text that is difficult to read</li> <li>• Some programs do not include references</li> </ul>	39.95–64.95
Handheldmed www.handheldmed.com	<ul style="list-style-type: none"> <li>• Merck Manual</li> <li>• 5-Minute Consult Series</li> <li>• Harrison’s Principles of Internal Medicine Companion Handbook</li> <li>• Taber’s Cyclopedic Medical Dictionary</li> <li>• DSM-IV</li> <li>• Common Symptom Guide</li> </ul>	<ul style="list-style-type: none"> <li>• Programs can be run from expansion memory card</li> <li>• Easy installation</li> </ul>	<ul style="list-style-type: none"> <li>• Limited search function</li> <li>• Finding information of interest requires significant scrolling</li> <li>• Updates must be purchased</li> <li>• Some programs do not include references</li> </ul>	49.95–79.95
Franklin Electronic Publishers www.franklin.com	<ul style="list-style-type: none"> <li>• Harrison’s Manual of Medicine</li> <li>• Merck Manual</li> <li>• Washington Manual of Medical Therapeutics</li> <li>• Clinician’s Pocket Reference</li> <li>• Emergency Medicine: A Comprehensive Study Guide</li> <li>• 5-Minute Consult Series</li> <li>• Oxford Handbook of Clinical Medicine</li> </ul>	<ul style="list-style-type: none"> <li>• Programs can be purchased as “plug and play” expansion cards</li> <li>• Information is organized by table of contents and alphabetical index</li> </ul>	<ul style="list-style-type: none"> <li>• Updates must be purchased</li> <li>• Expensive</li> </ul>	49.95–89.95
eMedicine www.emedicine.com	<ul style="list-style-type: none"> <li>• 65 textbooks organized by medical specialty</li> </ul>	<ul style="list-style-type: none"> <li>• Can be customized into smaller sections</li> <li>• Peer reviewed</li> <li>• Frequent updates</li> <li>• References included</li> </ul>	<ul style="list-style-type: none"> <li>• Large memory requirement</li> <li>• Updates must be purchased after 1 year</li> <li>• Limited search function</li> </ul>	99.00
Redi-Reference www.redi-reference.com	<ul style="list-style-type: none"> <li>• Clinical Guidelines</li> <li>• ID Handbook</li> <li>• Cardiology eText</li> <li>• Obstetrics for Primary Care Physicians</li> <li>• Biweekly Clinical Update</li> </ul>	<ul style="list-style-type: none"> <li>• Peer reviewed</li> <li>• Inexpensive</li> </ul>	<ul style="list-style-type: none"> <li>• Poor search function</li> <li>• Require significant scrolling to find information</li> <li>• Updates must be purchased after 1 year</li> </ul>	19.95–29.95

Note: DSM-IV = the *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed.

smaller sections, which allow users to customize content to meet their particular needs.

Redi-Reference<sup>11</sup> produces a series of original peer-reviewed electronic books designed specifically for the handheld computer. Surprisingly, Redi-Reference's Clinical Guidelines program is one of the few clinical practice guideline (CPG) resources available for the handheld. CPGs are one of the most obvious uses of handheld computers in clinical practice, because they can be easily accessed and updated on a handheld. We hope that CPGs will become more widely available in the future.

## Downloadable journal content

AvantGo is a useful program that allows Web information to be delivered to your handheld computer. Individual journals offer a variety of handheld content, ranging from tables of contents to full articles that can be downloaded to your handheld by performing a "hotsync," a function that synchronizes, or transfers, files between a desktop computer and a handheld.<sup>12</sup>

JournalToGo<sup>13</sup> provides a similar service. This service allows you to choose health-related channel subscriptions such as *Emergency Medicine*, *Family Practice* and *Reuters Health* and then sends you selected abstracts from leading medical journals, such as *JAMA*. JournalToGo bundles its programs with advertisements in order to supply its services free of charge.

CogniQ<sup>14</sup> offers a novel interface whereby questions encountered in clinical practice can be noted on a handheld and transmitted to CogniQ during a subsequent hotsync. The handheld interface allows you to choose the organ system for which current information is desired. During your next hotsync operation, the quick-reference portion of

*Clinical Evidence*, a summary of evidence-based findings from recent clinical trials, and the current table of contents from leading journals such as the *BMJ* and its specialty journals are downloaded to your handheld. *CMAJ* content will soon be available for download to a handheld on CogniQ. In addition to viewing these abridged resources, you can request full text for content of interest. On synchronization, these requests are sent to your personal library on the Web where you can link to full text of *Clinical Evidence* and the *BMJ* journals and perform MEDLINE searches. A free limited trial of this service is available.<sup>15</sup>

Highwire Press, which is home to more than 330 peer-reviewed journals, now offers handheld-downloadable content from medical journals, soon to include *CMAJ* (Holly Larocque, Electronic Publishing Manager, CMA Publications, Ottawa, Ont.: personal communication, 2003).

## Pharmacopoeias

Pharmacopoeias are an extremely popular resource for medical professionals (Table 2). A recent survey of internists by the American College of Physicians–American Society of Internal Medicine found that 80% of handheld owners use their devices to access drug information.<sup>16</sup>

ePocrates Rx 6.0<sup>17</sup> is one of the most widely used handheld medical programs.<sup>18</sup> PalmSource, the developer of the Palm OS, has recently recognized it with an award for the Best Enterprise Solution and Best Overall Solution.<sup>19</sup> With this free program, users can look up indications, dosages and side effects of medications by generic name, trade name or class. A "multicheck" can also be run to look for interactions between medications. In a recent online survey of 946 ePocrates Rx users by investigators at Harvard University sponsored by the manufacturer of ePocrates Rx,

**Table 2: Pharmacopoeias**

Program	Advantages	Disadvantages	Cost, US\$
ePocrates www.epocrates.com	<ul style="list-style-type: none"> <li>• Free</li> <li>• Integrated multicheck feature to search for interactions between medications</li> <li>• Database is automatically updated during hotsync</li> </ul>	<ul style="list-style-type: none"> <li>• Not as complete as other pharmacopoeias</li> <li>• Physicians' software use may be monitored</li> <li>• No Canadian brand names and availability</li> </ul>	Free
DrDrugs www.skyscape.com	<ul style="list-style-type: none"> <li>• Canadian brand names and availability</li> <li>• Wide breadth of information</li> <li>• Section on pharmacokinetics</li> <li>• Cross-referenced with other Skyscape products</li> </ul>	<ul style="list-style-type: none"> <li>• Updates must be purchased</li> </ul>	49.95
A2zDrugs www.skyscape.com or www.handheldmed.com	<ul style="list-style-type: none"> <li>• Wide breadth of information</li> <li>• Cross-referenced with other Skyscape products</li> <li>• Information on patient education</li> </ul>	<ul style="list-style-type: none"> <li>• Updates must be purchased</li> <li>• No Canadian brand names or availability</li> </ul>	49.95
MosbyDrugs www.skyscape.com	<ul style="list-style-type: none"> <li>• Wide breadth of information</li> <li>• Drug availability, mode of delivery and costs</li> <li>• Cross-referenced with other Skyscape products</li> </ul>	<ul style="list-style-type: none"> <li>• Updates must be purchased</li> <li>• No Canadian brand names or availability</li> </ul>	64.95
Lexi-Drugs Platinum www.lexi.com	<ul style="list-style-type: none"> <li>• Canadian brand names and availability</li> <li>• Extremely detailed information</li> <li>• Variety of tabs to find information quickly</li> </ul>	<ul style="list-style-type: none"> <li>• Updates must be purchased</li> <li>• Expensive</li> </ul>	75.00

50% of respondents indicated that the program helped them avoid one or more adverse drug events per week. In addition, more than 80% of respondents felt that ePocrates Rx allowed them to provide their patients with better information and helped them practise more efficiently.<sup>20</sup> ePocrates has recently launched a new premium pharmacopoeia service, ePocrates Rx Pro, for an annual subscription fee. ePocrates Rx Pro offers additional information on alternative medicines and their interactions with licensed pharmaceuticals, along with a new section of medication reference tables and a software application for infectious diseases. The AutoUpdate feature updates the program's medication database via the Internet each time the handheld is synchronized with a desktop computer.<sup>21</sup> However, prospective users should be aware that this AutoUpdate feature allows ePocrates to maintain records of software use, including the number of times that users have accessed information on particular medications.<sup>22,23</sup> Furthermore, the manufacturers of ePocrates may track Web sites that were visited before and after travelling to their site during a hot-sync. In addition, aggregate demographic and usage information may be shared with third parties, such as pharmaceutical companies and investment firms.<sup>22</sup>

Skyscape offers a variety of pharmacopoeias including DrDrugs (*Drug Guide for Physicians*), A2zDrugs (*A to Z Drug Facts*) and MosbyDrugs. These drug references offer a wider breadth of information than ePocrates, with sections on pharmacokinetics and pharmacodynamics. In addition, they can be seamlessly linked with other Skyscape applications, including *Griffith's 5-Minute Clinical Consult*. DrDrugs provides information on Canadian brand names and availability, a feature missing in ePocrates qRx. Lexi-Drugs Platinum<sup>24</sup> offers the most detailed drug information of all of the available pharmacopoeias. It also provides information on Canadian brand names and availability. The reference information in Lexi-Drugs is very well indexed with twice the number of tabs, or information categories such as "adverse reactions," as other pharmacopoeias. However, it is the most expensive of all of the available programs, with a price tag of US\$75. Although all of these pharmacopoeias list drug interactions, an additional program must be purchased, such as iFacts (*Drug Interaction Facts*) or DrugIx (*The Medical Letter's 2002 Handbook of Adverse Drug Interactions*), to provide the same easy multiple-drug interaction analysis feature that is present in ePocrates.

Many physicians are excited about the possibility of using handheld computers to prescribe medication electronically. Poor penmanship is legendary among busy physicians and has been the basis of negligence litigation, with at least one patient death known to have been caused by a pharmacist's misinterpretation of a physician's handwriting.<sup>25</sup> Electronic prescribing could not only reduce such errors, but it could potentially prevent harmful drug interactions by automatically cross-checking a newly prescribed medication with a patient's existing medications. Electronic prescribing could also theoretically be linked with decision support tools to

promote evidence-based drug therapy. Although software for handheld electronic prescribing is currently available,<sup>26</sup> this technology has yet to gain popularity.<sup>27,28</sup> Currently, the infrastructure for the widespread use of handheld prescribing is not in place. Beyond training physicians and pharmacists to use prescribing software, hospital and pharmacy computer systems must be revised to take advantage of handheld technology. Handheld prescribing may become a more viable alternative in the future, as health care systems evolve to accommodate emerging technology.

## Medical calculators

Health care providers often make medical calculations that affect patient care decisions. These calculations range from physiological parameters (osmolar gap, creatinine clearance) to severity indices (Glasgow coma scale, child cirrhosis score) to drug dosages (by weight in pediatrics or body surface area in oncology) to decision support tools (Bishop score, Ottawa ankle rules). A variety of useful medical calculators available for the Palm OS are listed in Table 3.

## Patient-tracking programs

Patient-tracking programs are ideal for physicians who carry a hefty inpatient load and require ready access to patient information at the point of care. With this software, users can keep track of patient demographic information, medication records and laboratory values. This information can be used to generate patient histories, progress notes and to-do lists that can be transferred to serial printers or "beamed" to infrared printers or other handheld computers. A list of the most popular patient-tracking programs can be found in Table 4.

All patient-tracking software, however, is limited by the time required to enter patient data. Most busy professionals do not have time to manually input all of their patients' laboratory parameters on a handheld. In addition, concerns have been raised about storing confidential patient information on handhelds.<sup>29</sup> Handheld-based patient-tracking software will only realize its full potential when it is integrated with hospital-based computer systems, so that patient information can be seamlessly transferred to handheld computers from existing hospital databases in a secure manner. In the United States, PatientKeeper was recently awarded a contract from a number of leading teaching hospitals, including the Childrens Hospital Los Angeles and the University of Maryland Medical System, to develop hospital electronic record-keeping systems that would be linked to its handheld PatientKeeper platform.<sup>30</sup>

## Billing and coding software

In Canada, between 5% and 15% of the average physician's gross income may not be billed or collected each year.<sup>31</sup> In an effort to improve billing efficiency and reim-

bursement rates, many physicians have turned to electronic solutions, including billing and coding software for hand-held computers. SureClaim inHand<sup>32</sup> allows users to magnetically swipe patients' bar codes to input patient data, like health card numbers and Ontario Health Insurance Plan (OHIP) diagnostic codes, with a peripheral add-on bar code scanner. With SureClaim's companion desktop software, physicians can manage billing records and submit claims directly to OHIP or the Workplace Safety and Insurance Board (WSIB) electronically. However, SureClaim

is expensive, with a single-user licence fee of Can\$998, plus an additional \$191 charge for the magnetic bar code scanner add-on. Free databases of Ontario Limited Use Codes, OHIP Fee Schedules and Ontario Medical Association (OMA) Fee Schedules for uninsured services can be downloaded to handheld devices.<sup>33</sup> Unfortunately, software with billing support outside the province of Ontario is not widely available at present.

There are a number of US programs that provide support for International Classification of Diseases, 9th revi-

**Table 3: Medical calculators**

Program	Description	Cost, US\$
MedCalc <a href="http://medcalc.med-ia.net">http://medcalc.med-ia.net</a>	<ul style="list-style-type: none"> <li>Widely used general purpose calculators for common equations in internal medicine</li> </ul>	Free
MedMath <a href="http://smi-web.stanford.edu/people/pcheng/medmath">http://smi-web.stanford.edu/people/pcheng/medmath</a>	<ul style="list-style-type: none"> <li>Widely used general purpose calculators for common equations in internal medicine</li> </ul>	Free
DoseCalcPlus <a href="http://pocket-doc.com">http://pocket-doc.com</a>	<ul style="list-style-type: none"> <li>Calculates drug dosages in pediatrics with drop-down menus and medication lists for easy reference</li> </ul>	20.00
PregCalc <a href="http://www.thenar.com/pregcalc">www.thenar.com/pregcalc</a>	<ul style="list-style-type: none"> <li>An electronic replacement for the pregnancy wheel in obstetrics</li> </ul>	24.95
MedRules <a href="http://pbrain.hypermart.net/medrules.html">http://pbrain.hypermart.net/medrules.html</a>	<ul style="list-style-type: none"> <li>A collection of clinical prediction rules taken from the medical literature</li> </ul>	Free
EBM Calculator <a href="http://www.cebm.utoronto.ca/palm/ebmcalc">www.cebm.utoronto.ca/palm/ebmcalc</a>	<ul style="list-style-type: none"> <li>Allows users to calculate likelihood ratios, numbers needed to treat and other relevant statistics for interpreting the results of clinical studies</li> </ul>	Free
ABGPro <a href="http://www.stacworks.com/index.html">www.stacworks.com/index.html</a>	<ul style="list-style-type: none"> <li>A handy program for interpreting arterial blood gas results</li> </ul>	Free
Anticoagulation Advisor <a href="http://www.anticoagulation-advisor.com">www.anticoagulation-advisor.com</a>	<ul style="list-style-type: none"> <li>A decision support tool for adjusting Coumadin dosages based on international normalized ratio (INR) values and previous doses received</li> </ul>	24.95
Cardiac Risk <a href="http://www.statcoder.com/cardiac.htm">www.statcoder.com/cardiac.htm</a>	<ul style="list-style-type: none"> <li>Useful for predicting a patient's 10-year risk of angina or myocardial infarction based on the results of the Framingham study</li> </ul>	Free
TIMI Risk <a href="http://www.timi.tv">www.timi.tv</a>	<ul style="list-style-type: none"> <li>A clinical prediction guide for treating patients with unstable angina and non-ST-segment elevation</li> </ul>	Free

**Table 4: Patient-tracking programs**

Program	Features	Cost, US\$
PatientKeeper <a href="http://www.patientkeeper.com">www.patientkeeper.com</a>	<ul style="list-style-type: none"> <li>Customizable pop-up menus and check boxes for fast data entry</li> <li>Easy-to-navigate icons and drop-down menus</li> <li>Can beam cross-coverage lists to other physicians</li> <li>Prints on infrared or serial printers</li> </ul>	35.00
Patient Tracker <a href="http://www.handheldmed.com">www.handheldmed.com</a>	<ul style="list-style-type: none"> <li>User can purchase Patient Tracker Desktop, a Windows-based program that allows users to input data on a personal computer and synchronize with their handhelds</li> <li>Prints on infrared printers</li> <li>Maintains list of medication favourites for easy reference</li> <li>Can beam cross-coverage lists to other physicians</li> </ul>	Free
WardWatch <a href="http://www.torlesse.com/pilot/wardwatch">www.torlesse.com/pilot/wardwatch</a>	<ul style="list-style-type: none"> <li>Has easy-to-navigate graphic interface</li> <li>Prints on infrared printers</li> <li>Can beam cross-coverage lists to other physicians</li> <li>Can export data to Microsoft Excel format</li> </ul>	29.95



sion (ICD-9), or Current Procedural Terminology (CPT) codes that some Canadian users may find useful for their practices. CodeMeister<sup>34</sup> and ClearCoder<sup>35</sup> allow users to search easily for diagnostic or procedural codes through a series of hierarchical drop-down menus.

## Handheld word processing and office programs

Word processing programs allow users to view Adobe files and create files in Microsoft Word, Excel and PowerPoint format on their handhelds. Documents To Go<sup>36</sup> is one of the most widely used multipurpose word processing programs. It has won numerous accolades, including *Handheld Computing Magazine's* Best Palm Powered Product 2001 and the Handango Champion Award "Best Business Solution 2002." Its greatest attribute is the ability to preserve the formatted appearance of a document between handheld and desktop. With Documents To Go, users can transfer files from a desktop to a handheld, make revisions to a document on their handheld and then transfer the revised file back to their desktop. Quickoffice<sup>37</sup> can be used to display graphs and charts on a handheld, along with standard word processing features. It is less expensive than Documents To Go and also allows users to buy components of this software package without having to purchase the full office suite. However, Quickoffice does not support Adobe files. Adobe files can be viewed with Adobe's Acrobat Reader for Palm OS.<sup>38</sup> Both of these programs offer support for high-resolution screens.

With the Presenter-to-Go expansion device, which can be inserted into a Secure Digital or Memory Stick expansion slot, handheld users no longer have to lug around their laptop computers for presentations. They can connect their handhelds directly to digital projectors or other video graphics array (VGA) displays and project their presentations in high-resolution colour.<sup>39</sup>

Finally, PrintBoy takes advantage of a handheld's infrared port to allow users to print directly from their handhelds to a printer with infrared support.<sup>40</sup> For printers without infrared access, an infrared adapter can also be added onto a parallel port slot.

## Utilities

Internal random access memory (RAM) and memory added through an expansion card are treated differently on a handheld computer, which is not the case for personal computers. In order to access software programs with large memory requirements stored on an expansion memory card, a small file often needs to be stored on the internal memory of a handheld for the program to run effectively. These small "program files" are designated with a ".prc" extension at the end of the file name. In contrast, larger database files, designated with a ".pdb" extension, can be stored on an expansion memory card so that programs with large memory requirements can run in an efficient manner.

Some newer software programs can be run directly from an expansion memory card, without having to store a program file on the internal memory of a handheld. One of the difficulties that users find is that the list of programs on their internal memory and the list on their memory card cannot be shown on the same screen, because the memory card programs are stored in a different category from that of the programs stored on the internal memory. Various launcher programs seamlessly integrate programs on the handheld and memory card. Silverscreen,<sup>41</sup> LauncherX<sup>42</sup> and Megalauncher<sup>43</sup> provide easy-to-use interfaces that allow users to access both their internal handheld memory and memory card programs on one screen. Silverscreen is the most popular option, providing a slick interface with many graphic themes to choose from. One limitation of Silverscreen is that files need to be moved from expansion cards to the internal handheld memory before they can be beamed to other handhelds. In contrast, Megalauncher and LauncherX allow for beaming directly from expansion memory. LauncherX also provides the nice feature of allowing users to organize their programs either alphabetically like other launchers or manually. Thus, one can manually set the launcher to display medical applications at the bottom of the screen, for example, permitting easy access.

Many handheld users worry about losing important personal information if their handheld device crashes. Blue Nomad's BackupBuddyVFS:Free is a handy freeware program that allows users to back up their handheld to their memory expansion card without having to create a special backup card.<sup>44</sup> A purchased version of this program can even be set to back up the handheld's internal memory at regular pre-directed intervals. This program provides the security of saving information from the handheld to an external source between hotsync operations or before the battery of a handheld device runs out.

## The cases revisited

### Case 1

On the elevator to the emergency department, Joanna takes a brief read through the section on ulcerative colitis in *Griffith's 5-Minute Clinical Consult* on her handheld. In doing so, she learns that she should ask her patient about arthralgias and ocular complications, including uveitis, and remembers to look for erythema nodosum and oral aphthous ulcers on physical examination. During her interview, Joanna finds out that her patient's colitis has been controlled with sulfasalazine, 500 mg 4 times a day, for a number of years. He mentions that he saw his family physician last week, who informed him that he has "borderline diabetes" and started him on glyburide, 1.25 mg once daily. He also takes ramipril, 10 mg once daily, for hypertension, atorvastatin, 20 mg once daily, for hypercholesterolemia and an occasional 325-mg acetaminophen tablet when osteoarthritis in his right knee troubles him. From her pa-

tient's history, Joanna worries about the possibility of a cardiac event. The findings of the ECG and cardiac enzymes are normal; however, the patient's blood sugar is slightly low at a value of 3.2 mmol/L. He feels much better after drinking an orange juice and eating a light snack. Joanna identifies glyburide as the likely cause of his hypoglycemia, but she wonders about a possible drug interaction given his low starting glyburide dose. She returns to the *Griffith's 5-Minute Clinical Consult* section on ulcerative colitis on her handheld and uses the "link" button to connect to Mosby's Drug Interaction Analyzer (MosbyIx). She consults the MosbyIx drop-down list of medications used in ulcerative colitis and she selects sulfasalazine. The next screen shows a list of drug interactions and the first listing is antidiabetic drugs and sulfasalazine. She discovers that sulfasalazine increases the risk of glyburide-induced hypoglycemia. She then uses the "Drug Selection" multidrug analyzer in MosbyIx and learns that there are no other medication interactions for her patient. After reviewing the case with her resident, Joanna decides to check her patient's blood glucose level and second set of cardiac enzymes before sending the patient home. His blood glucose level returns to 5.7 mmol/L and he indicates that he feels much better. The results of the second set of cardiac enzymes are negative. Joanna writes a letter to the patient's family physician recommending that his glyburide be discontinued and that he should instead be switched to metformin, 500 mg twice daily, for glycemic control. After finishing her letter, she uses CogniQ to request that review articles on inflammatory bowel disease be transmitted to her Web-based personal library during her next hotsync operation.

## Case 2

After reading the Kawasaki disease section in the *5-Minute Pediatric Consult* on his handheld, Dr. Edwards broadens his differential diagnosis to include measles, scarlet fever, Stevens-Johnson syndrome and Behçet's disease. Dr. Edwards then uses his handheld equipped with a digital camera add-on to take pictures of the patient's rash, fissured and ulcerated swollen lips, and her conjunctivitis. He connects his handheld to a desktop computer in the emergency department and sends the photographs by email to a pediatric specialist he has been in touch with at the Hospital for Sick Children, Toronto. The specialist agrees with Dr. Edward's provisional diagnosis of Kawasaki disease and recommends high-dose ASA and immunoglobulin therapy. He uses DoseCalcPlus to calculate the patient's required ASA dose of 325 mg every 4 hours. Arrangements are made to transfer her by air ambulance to the Hospital for Sick Children for immunoglobulin therapy and monitoring.

Dr. Edwards is also involved with resident teaching as part of the Rural Family Medicine program and would like to incorporate this case into his teaching seminars. Using Documents To Go and his foldable keyboard, he prepares a handout on pediatric skin rashes for his residents on his

handheld in between cases in the emergency department. After receiving consent from the patient's parents, he incorporates the photographs of her on his handheld into a PowerPoint presentation file and uses his Presenter-to-Go expansion device to project his presentation from his handheld computer at his resident teaching seminar 2 weeks later.

## Future directions

Handheld technology holds the promise of streamlining pager, cellular phone, Dictaphone and email messaging functions into a single device. Palm, the manufacturer of the original Palm OS handheld, recently announced a new partnership with WebLink Wireless to develop handheld computers with the ability to run on pager networks.<sup>45</sup> Palm has also formed a partnership with Good Technology, which manufactures a similar always-on, two-way email-messaging device to the popular Research in Motion (RIM) BlackBerry.<sup>46</sup> In addition, the new operating system for Palm-based handhelds (Palm OS 5) provides improved support for audio recording and playback. Using handheld devices that run Palm OS 5, physicians may be able to dictate clinical notes, letters and email messages directly into their handheld devices.<sup>47</sup> Palm OS 5 also features improved support for Bluetooth and 802.11b wireless networks,<sup>1</sup> raising the intriguing possibility that physicians may soon be able to dictate directly into their handhelds and have the text instantly appear on a personal computer screen at a remote site using voice-recognition word processing software.

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