Hand-held Computers for Family Physicians

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Hand-held computers such as the Apple Newton MessagePad, HP 200LX, Psion 3a, and Franklin DBS-2 are now powerful enough to be useful to family physicians in their care of patients. Each fits in a laboratory coat pocket, weighs a pound or less, costs less than $700, turns on instantly, and has excellent battery life. A wide variety of software, including computerized medical records, medical calculators, and medical references, is available.

Key words. Computers; computerized medical records; family physicians; medical informatics computing.
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While computers have seen wide application in medical billing, inpatient laboratory, and research applications, their use in the clinical setting by physicians has been quite limited. A variety of reasons may explain this lack of acceptance: unfriendly user interfaces, physician inability to use a keyboard, concern that the keyboard and monitor may interfere with the patient-physician relationship, and cost. A steadily increasing volume of reference and patient-related data, however, is increasing the appeal of computers for clinicians. Also, managed care creates new incentives for physicians to practice in a cost-effective manner, which can be facilitated by the quick access to information offered by computers.

A new generation of lightweight, easy-to-use, and relatively inexpensive hand-held computers addresses all these problems. In this article, the Apple Newton, HP 200LX, Franklin Digital Book System, and Psion 3A hand-held computers are described. Known as personal digital assistants (PDAs), each weighs a pound or less, costs under $700, fits in a physician's coat pocket, turns on instantly without a lengthy "boot" process, and has a battery life of at least 20 hours. The advantages and disadvantages of each PDA in the medical setting are discussed, along with an overview of available medical software, programming languages, and other sources of information for physicians. The features of each unit are summarized in Table 1, and a glossary of terms is presented in Table 2.

Apple Newton

When initially introduced, the Newton MessagePad (Apple Computer, Cupertino, Calif) was criticized for its lack of memory, short battery life, and inconsistent handwriting recognition. Apple listened to its critics and released the MessagePad 110 in 1994 and the MessagePad 120 (MP 120) in February of 1995 (Figure 1), both of which do an excellent job of addressing these concerns. An update to the Newton's operating system software, which will improve the unit's speed and functionality, is expected to be available this month (October). The original MessagePad 100, with upgraded memory and software, is still available at the time of this writing (March 1995) for only $199, while the new MP 120 retails for $599 in a 1MB random access memory (RAM) configuration and $699 for a 2MB RAM configuration with a fax/modem. Readers affiliated with an educational institution may qualify for a discounted price for the latter model of approximately $520.

The MP 120 weighs approximately 1 lb and fits comfortably in the pocket of a laboratory coat. The screen covers most of its surface area, and a small telescoping pen is stored internally in a spring-loaded compartment. It has a built-in speaker for sound reproduction, and additional

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Table 1. Comparison of the Characteristics of Four Hand-held Computers

Characteristics	Newton MP 120	HP 200LX	Psion 3a	Franklin DBS-2
Central processing unit (frequency)	ARM 610 reduced instruction set processor (20 mHz)	80C186 (7.91 mHz)	Proprietary 16 mHz chip	Proprietary 65C816 16 mHz chip
Operating system	Newt OS 1.3	MS-DOS 5.0	Proprietary multi-tasking (DOS-compatible files)	NA
Programming languages available	Newton Toolkit NS Basic Newt	Any DOS-based language	OPL is built-in (BASIC-like language)	NA
Screen	320×240 pixels	640×200 pixels	480×160 pixels	160×40 pixels
Sound/speaker	Yes	No	No	No
PCMCIA 2.0 for expansion	Yes	Yes	No	No
Battery life (type of battery)	20–50 hours (4 AA)	40 hours (2 AA)	200 hours (2 AA)	200 hours (2 AA)
Interface	Pen	Keyboard	Keyboard	Keyboard
Handwriting recognition	Yes	No	No	No
Keyboard	No	Yes	Yes	Yes
Applications				
Notepad	Yes	Yes	Yes	No
Address book	Yes	Yes	Yes	Add-on
Date book	Yes	Yes	Yes	Add-on
To-do list	Yes	Yes	Yes	Add-on
Calculator	Yes	Yes	Yes	No
E-mail	Yes (NewtonMail)	Yes (CC-Mail)	Add-on	No
Spreadsheet	Add-on	Yes	Yes	No
Database	Add-on	Yes	Yes	No
Financial	Yes (Pocket Quicken with 2 MB MP 120)	Yes (Pocket Quicken)	Add-on	No
Fax/modem	Optional (included with 2 MB version)	Optional	Optional	No
Size	203×100×30 mm	160×86×25 mm	165×85×22 mm	127×83×13 mm
Weight, g	540	312	275	132
Cost	MP 100: $179 MP 120, 1 MB: $599 MP 120, 2 MB with fax/modem: $699, $521 for educational users	1 MB: $549 2 MB: $699	512 K: $399 1 MB: $499 2 MB: $599	DBS-2: $129 DBS-2 with 1 book: $199 DBS-2D: $199 DBS-2D with 1 book: $259
Telephone	1-800-909-0260	1-800-443-1254	1-800-547-7466	1-800-762-5382

NOTE: "Add-on" refers to software that may be purchased separately.

RAM, a fax/modem, or a network connection can be added using the PCMCIA version 2.0 plug-in card slot. All MessagePads also have a serial port, which can connect them to an external modem, a printer, or a desktop computer. Software is available to automatically exchange and synchronize information with either Macintosh or Windows-compatible personal computers. An infrared transmitter/receiver port allows for wireless transmittal of data (beaming) between two Newtons, or between a Newton and a printer with an infrared port. This capability is especially useful for physicians who wish to share patient information, such as a to-do list or a sign-out list. A wireless version of the Newton called the Marco (Motorola Corporation, Schaumberg, Ill) has just been released, which enables the user to remain connected to a central computer. In this way, physicians can access records stored on a central computer and send information to a printer, all while walking around their offices. Built-in software for the Newton includes a notepad, calendar, to-do list, calculator, electronic mail, and fax software. Well over one thousand programs have been written for the Newton, including references, specialized calculators, spreadsheets, databases, and electronic versions of books.

The major advantage of the Newton for physicians is that one interacts with it using a pen, much as with a traditional paper-based medical record. Its small size and familiar tablet-like shape allow it to resemble a traditional record, making it less likely to interfere with the patient-physician interaction. The Newton also comes with a feature known as "Newton Intelligence," which assists users by anticipating their needs. For example, writing "Fax Laura" on my (M.H.E.) Newton and pressing the "assist" button results in the Newton creating a fax cover page and addressing it to my wife at her office with her office fax number filled in. If there were more than one person named Laura, I would have been able to choose from a list. Because all information in the Newton is stored in a single "soup" of data, it is possible to quickly find all references to a patient, address, diagnosis, or any

Table 2. A Glossary of Hand-held Computer Terms

Term	Definition
Byte	A single character of information, such as a letter or digit
CGA	A standard for computer displays, it supports a resolution of up to 320 by 240 pixels in graphics mode or 80 characters by 25 lines in text mode.
DBS-2	The Franklin Digital Book System 2, a hand-held computer.
Handwriting recognition	The ability of a computer to convert handwriting to typed characters, which can then be stored and manipulated. The Newton is the only computer reviewed in this article to support handwriting recognition.
HP 200LX	The Hewlett-Packard 200LX, a hand-held computer.
Infrared transmission	A way to send information between two computers or a computer and a printer. It requires that the computers be within a few feet of each other, and is also called "beaming."
K	Kilobyte, equal to 1024 bytes.
MB	Megabyte, equal to 1024 kilobytes, or just over one million characters (about the size of a printed Bible).
MP 120	The Newton MessagePad 120, a hand-held computer.
PCMCIA 2.0 card	About the size of a thick credit card, these can contain devices such as from 1 to 80MB of additional RAM, a standard fax/modem, a network connector, or a wireless fax/modem.
PDA	Personal digital assistant; another term used to describe hand-held computers, although often used to refer only to those that support handwriting recognition.
Pixel	A single dot on a computer screen that can be on or off; used to describe the resolution of the screen. A typical desktop computer screen supports a resolution of 640×480 pixels (VGA) or 800×600 pixels (SVGA).
Psion 3a	The Psion 3a, a hand-held computer.
RAM	Random access memory, which is used by hand-held computers to store information. Unlike desktop computers, RAM in hand-helds is "nonvolatile," meaning that information does not disappear when the device is turned off.
Serial port	A serial port is a standard input/output device used to connect a computer by cable to a fax/modem, printer, scanner, or other device.

Figure 1. The Newton Message Pad 120 is a pen-based, hand-held computer from the Apple Corporation which incorporates handwriting recognition. It weighs 1 lb, and measures 8×4×1.2 in. The Newton has the widest variety of medical software available of any hand-held computer, including both commercial and "shareware" software.

other piece of data. For example, since I label each student-advising session in my calendar with the student's name and the term "Yr 3," it is possible to use the "find" function to quickly generate a list of all of my advisees, and the date and time of their appointments.

One disadvantage of the Newton is its size. At ap-proximately 1 lb, it is slightly larger and heavier than the other computers in this review. Another is the limited capability of its built-in handwriting recognition software. Over time, the Newton's built-in software "learns" to better recognize the handwriting of the owner, who also learns to write in a way that the Newton can better understand. Frequently used words can be added to the Newton's built-in list of words, so that entries can be made more quickly and accurately in the future. Recently, a program called *Graffiti* (Palm Computing, Los Altos, Calif) became available. It uses a special, easily learned printed alphabet that speeds data entry, particularly for words that are not in the Newton's word list, and enables extremely accurate handwriting recognition. *Graffiti* costs $59.00 and is highly recommended for Newton users.

The Newton MP 120 has the widest variety of medical software available of any hand-held computer. *Pocket Doc* 1.1 ($450 single-user license, $250 for residents and students; Physix Corporation, Houston, Tex) is a complete medical record that includes pharmacy and Interna-

tional Classification of Diseases, 9th Revision (ICD-9) code information. Written by a physician, it uses an encounter-based record system in which each patient encounter is a separate record. The production of notes is facilitated by extensive pop-up lists of medical phrases in customizable clinical templates on which the appropriate phrases can be tapped. A profile screen that resembles an electronic version of the familiar inpatient index card contains fields for the encounter note text, a problem list, and a medication list. For more information on this product, see the software review of *Pocket Doc* in this issue of *The Journal of Family Practice*. A similarly comprehensive product is *Hippocrates* (Health Care Communications, Lincoln, Neb), which also allows entry of graphics and has an operational link to a personal computer-based patient record system.

Med Notes (Education Research Laboratories, Inc, Fort Worth, Tex) provides a very useful but somewhat less comprehensive electronic medical record for $159. Patient files are maintained on a list that can be searched alphabetically, by assigned physician, or by location. SOAP format notes are entered by handwriting, by tapping on a keyboard icon, or by using a pop-up list of medical terms. Notes for a patient can be viewed sequentially or by SOAP heading. Diagnoses, procedures, medications, and laboratory results are shown on individual summary pages. Using the software's dosage calculator and expandable lists of medications, physicians are able to write prescriptions, which can then be faxed or printed. Help is available from within the program.

A simpler, but still quite useful, patient record program is called *MD3*. Patient demographics, history of present illness, medication, and a problem list are summarized on a single screen. Tapping a list displays it in an editable field, and tapping the appropriate button brings up to-do lists, a list of tests ordered, or health maintenance procedures. Patient sign-out lists and to-do lists can be faxed or printed. This application was designed to assist residents in maintaining patient information, but lacks some of the sophisticated patient record-keeping features available in commercial software. Nevertheless, it is a very serviceable program, and the price (free) is attractive.

ScutMaster and *MediCalc* are applications that assist with medical calculations. In the former, laboratory values can be entered to determine the arterial-alveolar gradient, renal failure index, creatinine clearance, expected acid-base compensations, and the corrected Q-T interval. Formulas and assumptions used in the calculations are shown when an "info" button is tapped. *Medicalc* facilitates the calculation of anion gap and osmolality, body surface area, absolute neutrophil count, and doses of pediatric, emergency, and intravenous medications. The medication lists, which contain brief information about each

drug, can be edited and augmented. A commercial version (*Medicalc 2.0*), which will be released soon, will add more formulas and clinical pearls.

Prescriptions on Tap is a prescription writer that stores commonly used prescriptions in an alphabetically indexed list. A screen organized to look like a typical prescription appears when a drug is selected, allowing editing before it is faxed or printed. Pressing an "Rx info" button brings up a dose calculator, and displays an editable area for entering more information about the drug for future reference.

A variety of reference texts are available for the Newton, including *The Little Black Book of Primary Care Pearls and Reference* and the entire *Current Clinical Strategies* series (Education Research Laboratories, Inc, Fort Worth, Tex). The latter is a medical reference series and is available as a medicine series that includes medicine, outpatient medicine, critical care medicine, and diagnostic history and physical examination, and as a specialty series that includes surgery, pediatrics, and obstetrics/gynecology. Charts, references, and an advanced cardiac life support protocol are included in both series. *The Little Black Book of Primary Care Pearls and Reference* is a handy quick reference for primary care information and clinical pearls, with extensive supporting references. All of the above references have excellent search capabilities, and the Newton screen size, 55 characters by 20 lines, allows fairly rapid reading. Because they also use a great deal of memory, a 2MB ($100) or 4MB ($200) flash memory card for the PCMCIA slot is recommended.

Medical shareware for the Newton, for example, *MD3*, *Prescriptions on Tap*, *MediCalc*, *Drug Finder*, and *ScutMaster*, are available from commerical online services such as America Online (keyword PDA) and CompuServe (GO NEWTON), as well as at an Internet World Wide Web site (http://med-amsa.bu.edu/newton.medical/newton.medical.html). More medical software is expected, since Apple has focused its marketing and development efforts on vertical markets such as the health care field. A "Newton Health Solutions Guide" can be obtained by sending a request via electronic mail to newton.med@appleLink.apple.com, or by calling 1-714-222-2608.

Hewlett-Packard 200LX

The Hewlett-Packard 200LX (HP 200LX, Hewlett-Packard Corporation, Corvalis, Ore) is a widely used hand-held computer that uses the industry-standard MS-DOS 5.0 operating system (Microsoft Corporation, Red-

Figure 2. The Hewlett-Packard 200LX is a palmtop computer with miniature keyboard which uses the DOS operating system. It comes with a wide variety of useful software built in, weighs 10 oz, and measures 6.5×3.5×1 in. The HP 200LX's ability to run DOS programs is a significant strength.

mond, Wash), the only one reviewed in this article to do so (Figure 2). Weighing 11 oz with batteries, the 200LX fits nicely into a laboratory coat pocket or the inside pocket of a suit jacket, although it will not fit comfortably in a pants pocket. The dark gray plastic case is ribbed for easy gripping. It opens up to expose a 4.75×1.75-in. screen capable of displaying 80 columns by 25 rows of text. The screen has a gray-black tint on which characters and images are displayed in dark black. The 200LX sports a keyboard that has 80 keys, including 10 function keys, 8 blue keys used to run the built-in software programs, and a separate numeric keypad. It does not support use of a pen or other pointing device. While the keys provide excellent tactile feedback (a physical click is registered after each keystroke), do not expect to touch-type with the 200LX because the keys are small and closely spaced. The 200LX is available in versions with either 1MB or 2MB of RAM for $549.00 and $699.00, respectively.

The HP 200LX includes a 10-pin serial port, a built-in infrared transmitter/receiver, and a PCMCIA version 2.0 plug-in card slot. These expansion and communication abilities make the 200LX a very powerful computing device. The 10-pin serial port can connect the 200LX to an external modem, a printer, or a desktop computer. The infrared transmitter/receiver port allows for wireless transmittal of data between two separate 200LXs or between one 200LX and another wireless device. The PCMCIA version 2.0 slot allows the user to add a card for additional storage space, a fax/modem, or a

combination fax/modem and memory card. Hewlett-Packard also offers an optional Connectivity Pack ($119.95) for file transfer between a 200LX and a DOS-compatible personal computer. In addition, *PalmConnect* (Palm Computing) is a package that allows the 200LX to directly connect to and share data with any Windows-compatible personal computer. Furthermore, *PalmConnect* will compare data on the two machines it connects and automatically update each machine. A function of *PalmConnect* important to physicians is that any patient data entered into the database offsite can be easily transferred to a Windows-compatible PC in the office, eliminating the need to input the information twice. The Newton MessagePads and Psion 3a also offer the ability to synchronize information in this way.

The HP 200LX offers a broad array of built-in applications, including MS-DOS 5.0, *Pocket Quicken* financial software, the *Lotus 1-2-3* release 2.4 spreadsheet, a calendar and appointment program, an address book, and a highly functional Hewlett-Packard calculator. These programs store their information such as dates and addresses in the available system RAM (either 1MB or 2MB). Other built-in applications include electronic mail (cc:Mail Remote), data communications that permit connection with other computers using a modem, a memo editor with outliner, a notetaker, and a simple database, giving the HP 200LX the best selection of built-in software of any hand-held computer. Because the HP 200LX uses MS-DOS 5.0, users can run any DOS application originally written for an IBM-compatible personal computer that requires no more than a CGA display and 550K of memory.

Numerous shareware and freeware programs designed specifically for use with the HP 200LX are available to download, ie, transfer to the user's computer via modem, from online services. Although most of these programs complement the business applications of the 200LX, a few are written to assist family physicians and medical students. Programs available on the American Medical Informatics Association forum on CompuServe (GO MEDSIG) include a form to aid medical students in their history and physical examinations and a form that describes the steps in caring for a patient with an acute myocardial infarction, which may be more useful to practicing physicians. Programs that help a physician calculate a dosing schedule for aminoglycosides, and another for pressor drip rates also are available. These programs are available from online services such as America Online (keyword PDA) and CompuServe (GO HPHAND). A World Wide Web site for the HP 200LX also exists (http://www.io.com/~rob/hp2001x/).
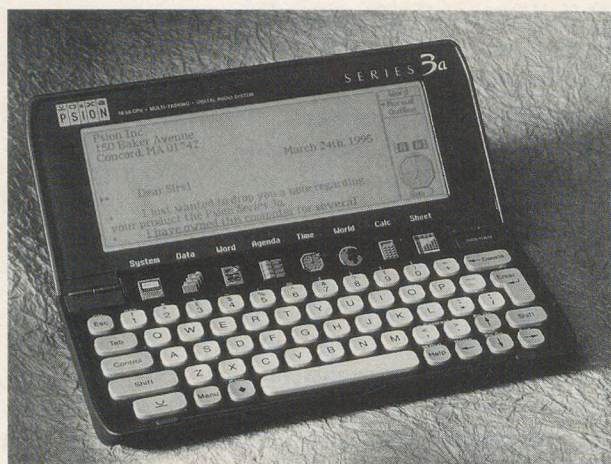
Figure 3. The Psion 3a is a palmtop computer with miniature keyboard. It comes with a full-featured set of built-in software (word processor, spreadsheet, and database), weighs 9 oz, and measures 6.5×3.5×1 in. Although relatively little medical software has been written for the Psion 3a to date, it is the most popular hand-held computer in Europe, and more medical applications should be forthcoming.

Psion 3a

The Psion series of hand-held computers (Psion Inc, Concord, Mass) is advertised as the best-selling hand-held computer in the world (Figure 3). Most popular in Europe, where over one million have been sold, the Psion is a very compact and powerful device. It uses a small keyboard for input and can also record brief voice messages. It does not support use of a pen or other pointing device. The Psion Series 3a computer costs $399 with 512K of memory, $499 with 1MB, and $599 with 2MB.

The Psion is very compact, weighing only 11 oz. It unfolds to reveal a small horizontal screen that displays 80 characters by 17 lines of text (480 by 160 pixels). While the screen is small, the resolution is quite high. The keyboard has a softer feel than that of the HP 200LX, and has some nonstandard placement of keys, such as £ over the 3, which reflects its British origins. Like the HP 200LX keyboard, it is too small for touch-typing, and is not suitable for entering large amounts of text. A small microphone and speaker allow the user to easily record brief messages for later playback. The Psion also has a serial port for connecting it to an external fax/modem, other computers, or a printer.

The Psion comes with a variety of built-in software, including an organizer, simple database, spreadsheet, word processor, and programming language. The programming language is similar to BASIC and is quite full-featured. The word processor includes a spell checker and thesaurus and uses the same file format as Microsoft Word
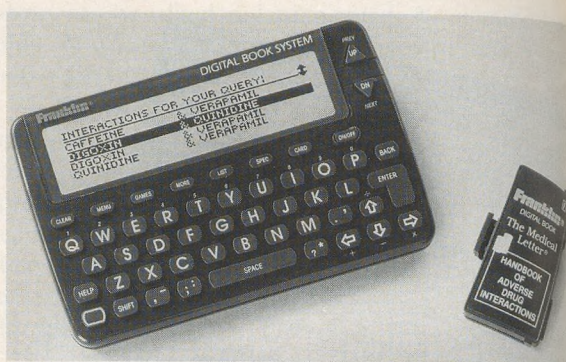

Figure 4. The Franklin Digital Book System is primarily a reference tool, which stores information on tiny "digital book" chips. The unit weighs only 4 oz, measures 5×3.5×0.5 in, and can hold two digital books at a time.

for DOS (Microsoft Corporation). The spreadsheet uses the industry-standard *Lotus 1-2-3* format, which allows easy transfer of documents to and from the Psion. Software is also available at additional cost to link the Psion 3a to an IBM-compatible computer and synchronize data between the two machines. Currently, the selection of software for the Psion 3a is more limited than that for the Newton and HP 200LX.

The greatest strengths of the Psion are the high quality of the built-in software, the unit's speed, and the excellent battery life (up to several months of regular use). The biggest disadvantage for physicians is the relative lack of medical software. The only package currently available is called *SmartDocs* (Berdy Medical Systems, Rochelle Park, NJ), which is reviewed in this issue of *The Journal of Family Practice*. It helps physicians accurately capture all appropriate ICD-9 and Current Procedural Terminology (CPT) codes during hospital rounds. No medical reference software is currently available for the Psion 3a. The PDA forum on America Online offers Psion shareware for downloading (keyword PDA).

Franklin Digital Book System

The Franklin Digital Book System (DBS-2, Franklin Electronic Publishers, Mt Holly, NJ) is a pocket calculator-sized device that uses plug-in modules called digital books to display text from condensed versions of major references (Figure 4). The DBS-2 measures 5×3.5×0.5 in, weighs just 4 oz, and has an outstanding battery life. It contains a small 5-line textual display that does not support graphics such as figures or diagrams; however, font size and display contrast are easily adjustable. A standard serial port permits communication with a modem or desktop computer. The Franklin DBS-2 has a list price of

$129, while the larger DBS-2D costs $159. The latter is a somewhat larger desktop model that holds two digital book modules. Both the DBS-2 and DBS-2D are available bundled with software: either the *Physicians' Desk Reference (PDR)* or *The Merck Manual* for $199 or $259, respectively.

The digital books each hold up to 20MB of compressed information. Available digital books include the *PDR*, *Harrison's Principles of Internal Medicine*, the *Washington Manual*, the *Medical Letter*, the *Harriet Lane Handbook of Pediatrics*, and *The Merck Manual*. A personal organizer that includes an address book, phone book, scheduler, and world clock is also available, as is a variety of general reference, special interest, and entertainment software. The *PDR* and *The Merck Manual* each cost $129 when sold separately; other digital books generally cost $99. A special pager card, which permits the DBS-2 to act as an alphanumeric pager through the Skytel network, should be available later this year.

The digital books can be searched by scrolling through either a table of contents or an alphabetical index of subjects or by simply doing a word search. The latter seeks occurrences of a word in the text and displays any matches. An "ordered search" allows combinations of words to be found, whereas a "search width" function determines how far apart words can be and still produce a match. The user can scroll through the text line by line or screen by screen and can also add notes to the text for later reference.

The DBS-2's major advantage is the ability to display a wealth of medical reference information from a variety of sources in a very compact device. The main disadvantages of the DBS-2 are the high cost of digital books, the small screen size, which greatly slows reading, and its inferior capabilities as a personal information manager, as compared with the other devices reviewed. In addition, medical calculator and medical record software are not currently available for the DBS-2.

Creating Your Own Software

Three of the hardware platforms described above allow users to create their own software. The sophistication, cost, and complexity of programming languages vary considerably. The Psion 3a is the only hand-held computer that comes with a built-in programming language, called OPL, which is similar in syntax to BASIC. The Franklin Digital Book System is not programmable, and is limited to titles published in digital book format by the Franklin Corporation.

For the Newton, the *Newton Toolkit* is currently the only way to create applications that take advantage of all of the Newton's features ($499, Apple Computer). It requires a Newton and a Macintosh or PowerMac computer. A *Newton Toolkit* for Windows is currently being prepared for IBM-compatible personal computers, and is expected to be released later this year. *NS Basic* (NS Basic Corporation, Toronto) for the Newton is a less expensive but somewhat more limited programming language that is useful for simple applications. It does not require a desktop computer, although it will work with both Macintosh and IBM-compatible computers. *Paperback* (David Fedor, fedor@newton.apple.com) is a free software program for both Macintosh and IBM-compatible computers that quickly and easily converts any text to a form that can be stored and viewed on the Newton. It supports full-text searches using the Newton's built-in "find" feature.

Because the HP 200LX uses the DOS operating system, any programming language for IBM-compatible computers, such as *QuickBasic* (Microsoft Corporation), can be used to develop applications. It also comes with a built-in application for creating simple databases and is able to run DOS database programs, such as *FoxPro* (Microsoft Corporation).

How to Learn More

A number of books and magazines are available for those who want to learn more about hand-held computers. Books about the Newton include *Newton's Law* by Andrew Gore and Mitch Ratcliffe (Random House, New York, 1993; ISBN 0-679-74647-1) and *Programming the Newton* by Julie McKeehan and Neil Rhodes (Academic Press, Cambridge, Mass, 1993; ISBN 0-12-484800-1). The latter comes with a free demonstration version of the *Newton Toolkit* for Macintosh computers. Magazines about hand-held computers include *Pen Computing* (Pen Computing Inc, Folsom, Calif), *PDA Developer* (Creative Digital Inc, San Francisco, Calif), and *HP Palmtop Paper* (Thaddeus Computing Inc, Fairfield, Iowa). To find a dealer near you who sells hand-held computers, call the manufacturer (Table 1).

America Online has a "Personal Digital Assistant" (PDA) forum that has conversations about each type of computer, hundreds of shareware programs (software that can be downloaded from online services and previewed before paying for it), and tips for new users. To access it, log on to America Online, and select keyword PDA. CompuServe has similar forums for Newton and HP 200LX users (GO NEWTON and GO HPPALM). On the World Wide Web, you can learn more about the Newton at the Newton Medical site (http://med-amsa. bu.edu/newton.medical/newton.medical.html) and

about the HP 200LX at http://www.io.com/rob/hp200lx/.

Summary

Powerful new hand-held computers can help family physicians organize their lives and practices, and give them rapid access to important medical references and medical records. These devices have the potential to help physicians save time and money while improving the quality of care they provide to patients. For students and residents, they serve as a powerful tool for accessing and organizing personal and patient-related information.

Authors' Note

This article is the result of collaboration among four family physicians interested in the use of hand-held computers. Questions about the Newton should be directed to Dr Ebell (mhebell@med.wayne.edu) or Dr Hale (fmghale@med.unc.edu); about the HP 200LX to Dr Buchanan (joeledbuch@aol.com) or Dr Dake (102037.2604@compuserve.com); about the Psion 3a to Dr Ebell; and about the Franklin Digital Book System to Dr Hale or Dr Buchanan. Questions about programming or online services should be directed to Dr Ebell.