

PDA's in Medicine

Vernon W. Huang, MD



PDA's in Medicine

- **WHAT** is a PDA?
- **WHY** are they important in medicine?
- **WHO** makes and has used them?
- **HOW** can I use one?
- **HOW** can I create PDA software?



What is a PDA?

- Defined by Apple CEO John Scully in 1992
- Referred to Newton, a handheld device to:
 - Capture
 - Organize
 - Communicate
- **Ancestry:** knowledge Navigator, AT&T Eo, Go Penpoint
- **Evolution:** Palm, WindowsCE/PocketPC



What is a PDA?

P

- ✓ Personal
- ✓ Portable
- ✓ Powerful

D

- ✓ Digital
- ✓ Diverse Applications

A

- ✓ Assistant
- ✓ Affordable

⚡ 1990 (concept)

⚡ Small Size: like a notebook computer

⚡ Light Weight: 4-6 pounds

⚡ Low Cost: <\$4000

⚡ Long Battery Life: 3-4 hours



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- ✓ Affordable

➤ 1996 (Newton MessagePad)

- Small Size: fit in a white coat pocket
- Light Weight: under 1 pound
- Low Cost: <\$1000
- Long Battery Life: one shift of frequent use



What is a PDA?

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- ✓ Personal
- ✓ Portable
- ✓ Powerful

D

- ✓ Digital
- ✓ Diverse Applications

A

- ✓ Assistant
- ✓ Affordable

⚡ 2002 (Palm/PocketPC)

- ⚡ Small Size: fit in a shirt pocket
- ⚡ Light Weight: under 1/4 pound
- ⚡ Low Cost: <\$500
- ⚡ Long Battery Life: days of frequent use



What is a PDA?

A Real Life Example of Moore's Law

	1990 (concept)	1996 MessagePad	2002 Palm/PocketPC
Size	Tablet	Coat pocket	Shirt Pocket
Weight	4-6 lbs	Under 1 lb	< 1/4 lb
Cost	<\$4000	< \$1000	< \$500
Battery Life	3-4 hrs	Days	Weeks



A PDA is *not*:

- A replacement for desktop computers
- A shrunk down version of an existing operating system
- A stand-alone device



Why PDA's?

How is mobile information currently managed

- 3x5 index cards
- 8 1/2 x 11 paper
- Laptops on wheels
- Ubiquitous computer terminals



Why PDA's?

Isn't paper good enough?

- Advantages
 - Portability
 - Easy access
 - Fast data entry
 - Persistence
 - Low cost
 - No training required
- Disadvantages
 - Limited space
 - Personal shorthand
 - No backup
 - Static view
 - Volatility



Why PDA's?

Forces driving adoption of PDA's in Healthcare

- Rapidly rising cost of healthcare
- Greater awareness of medical errors
- Increased physician demand
- Increased demands on physicians
- Advances in technology



Why PDA's?

Rising Costs of Healthcare

- Healthcare accounts for 14% (\$1.2 Trillion) of GDP in 1998
- Costs expected to be over \$2.2 trillion this year
- US Prescription costs represent \$100B growing at 15% annually
- Generic Switching and Formulary Compliance = 3-4% savings



Why PDA's?

Greater awareness of medical errors

- IOM Study: 98,000 deaths/year
- Errors cost society \$15B/yr
- ~ 25% secondary to poor handwriting
- Texas physician ordered to pay \$225k for poor handwriting

Patients demand and deserve better care!!



Why PDA's?

Increased Physician Demand

- Many **medical students** and **residents** being issued PDA's and *required* to use them
- Increasing complexity of disease management driving physicians to better methods of information management
- Increasing number of medical graduates computer literate



Why PDA's?

Increased Demands on Physicians

- Up to 46% of a physician's day is lost in administrative tasks
- Physicians are seeing more patients per day while getting paid less for their services.



Why Now?

Advances in technology

- Devices converging: PDA's, cell phones, pagers
- Acceptable Form factor: smaller, less intrusive devices
- Price: 1/5 the cost of desktops in terms of capital and support
- Improving Technology:
 - Connectivity
 - Screen technology
 - Battery life
 - Memory capacity



Who do I go to?



Pocket PC



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Who makes PDA's?

Palm OS Devices

- 79% market share in US
 - Palm 58%
 - Handspring 15%
 - SONY 6%
- Nice blend of form and function
- Simple and intuitive applications
- Limited processor and memory, poor screen resolution



Who makes PDA's?

Pocket PC

- Don't ever bet against Microsoft
- Market Share increasing dramatically
 - Compaq from 2 to 7% PDA units
 - H-P from 3 to 5% PDA units
- Powerful, full-featured
- Shorter battery life
- Larger than Palm, but still passes the white-coat test



Where we are today...

Others:

- Psion
- Research in Motion
- WAP Phones
- Many more to come...



Advantages: Hardware

Size: Palm

However, we haven't seen real innovation in a long time

Weight: Palm

Battery Life: Palm

Screen Size/Resolution: PocketPC

Processor Speed/Memory: PocketPC

(but may not be reflected in end user experience)



Advantage: Built in Software

Ease of Use: Palm

Function: Windows CE

Windows CE has the distinct advantage of including “Pocket” versions of their office suite allowing viewing/editing of documents on the PDA. Also, MS has included extras like ebook readers, voice recorders and MP3 Players



Advantage: Third Party Software

Palm: Tens of thousands of developers who have learned a new development environment and recognize that handheld computing is a different paradigm.

Microsoft potential: Can leverage existing code base but run risk of “shoehorning” desktop solutions into a PDA



Advantage: Connectivity

Microsoft:

- Faster synchronization times
(690kbps vs 115.2 kbps)
- Serial vs. USB options in same device
- Better integration with Windows OS
- No support for other Operating Systems



Who has used PDA's

- Studies in PDA usage for
 - References
 - Patient Diaries
 - Patient Surveys



Use of PDAs by Residents

The Constellation Project: Experience and Evaluation of Personal Digital Assistants in the Clinical Environment

Labkoff SE, Shah S, Bormel J, Lee Y, Greenes RA

SCAMC, 1996



Constellation Results

- PDA accessed 3486 times by 28 residents
- Average 1.25 uses/day/resident
- Overall the PDA (Newton MessagePad 100) was:
 - a time-efficient way to get reference info (22/28).
 - portable
 - too big/too heavy (10/22)

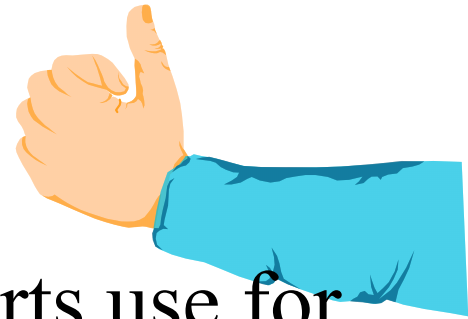


Available medical references

- Epocrates
 - Rx and ID guide in use by 25% of all physicians
 - Free !!!
 - Autoupdate via IP based syncing
- PocketMedicine
 - New company creating PDA specific content by known authors
- Handheldmed
 - Porting of popular medical handbooks to PDA format



Overall Assessment



- Evidence (and the masses) supports use for storing and retrieving small amounts of text
- Opportunities for improvement with newer technology that promise even more utility



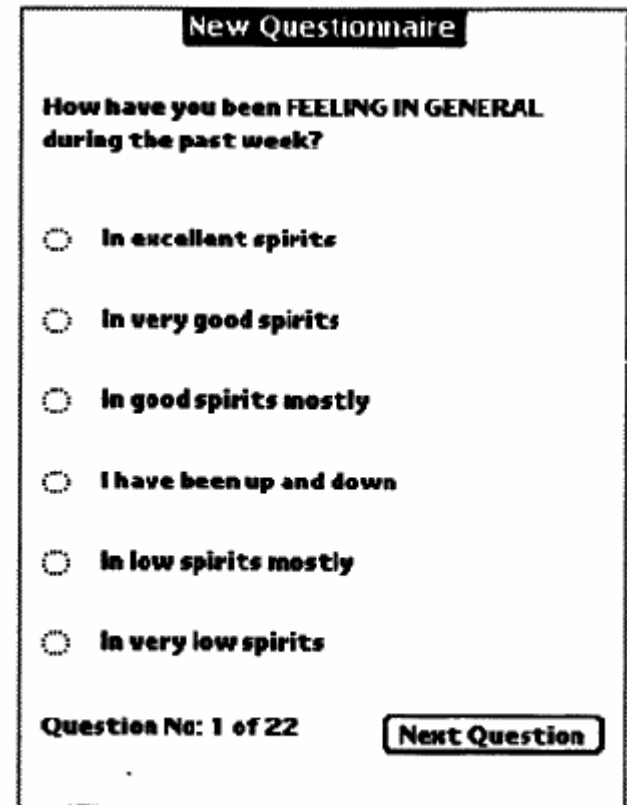
PDA as a Forms-based Data Entry Tool

- Electronic Diaries
- Surveys
- Guideline-based Documentation



PDA as an Electronic Diary

- Use pen to select responses
- Can capture text responses
- Can skip irrelevant questions
- Can ensure accurate and complete data



New Questionnaire

How have you been FEELING IN GENERAL during the past week?

☐ In excellent spirits

☐ In very good spirits

☐ In good spirits mostly

☐ I have been up and down

☐ In low spirits mostly

☐ In very low spirits

Question No: 1 of 22 **Next Question**

Figure 1. A question from the PGWB section of the electronic questionnaire. The subject tapped the appropriate box with a stylus to indicate the response.

Example Domains

- Diabetes
- Asthma
- Gynecology
- Headaches
- Quality of life
- Nutrition
- Pain
- Smoking Cessation



Advantages Over Paper

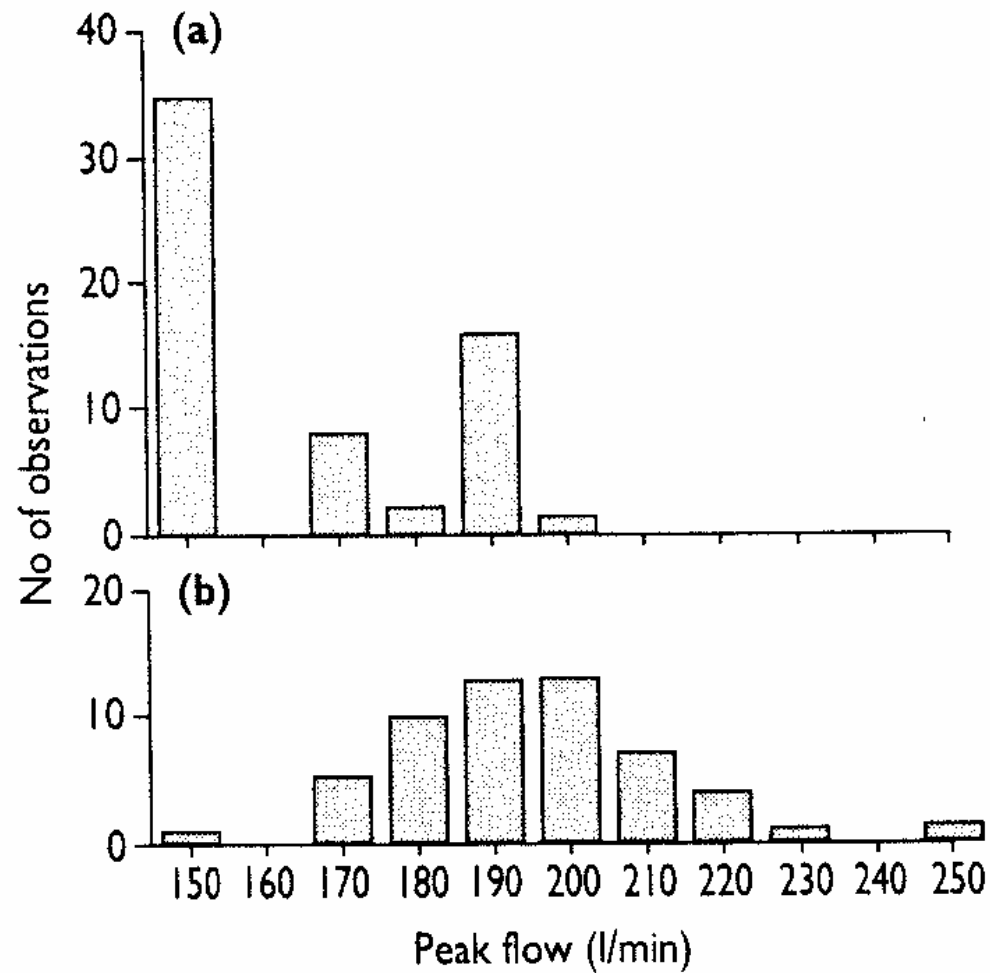
- Automatic date/time stamping
- May be more available if device is carried everywhere
- May be more interesting to use



Electronic Diaries for Asthma

- Filled out randomly mornings and evenings for 4 weeks.
- Used PDA and paper surveys to record
 - Peak flow
 - Medication use
 - Symptoms
- 13/19 preferred electronic; 5 paper; 4 no pref
- Higher proportion of missing data using PDA (did not allow data to be entered retrospectively)

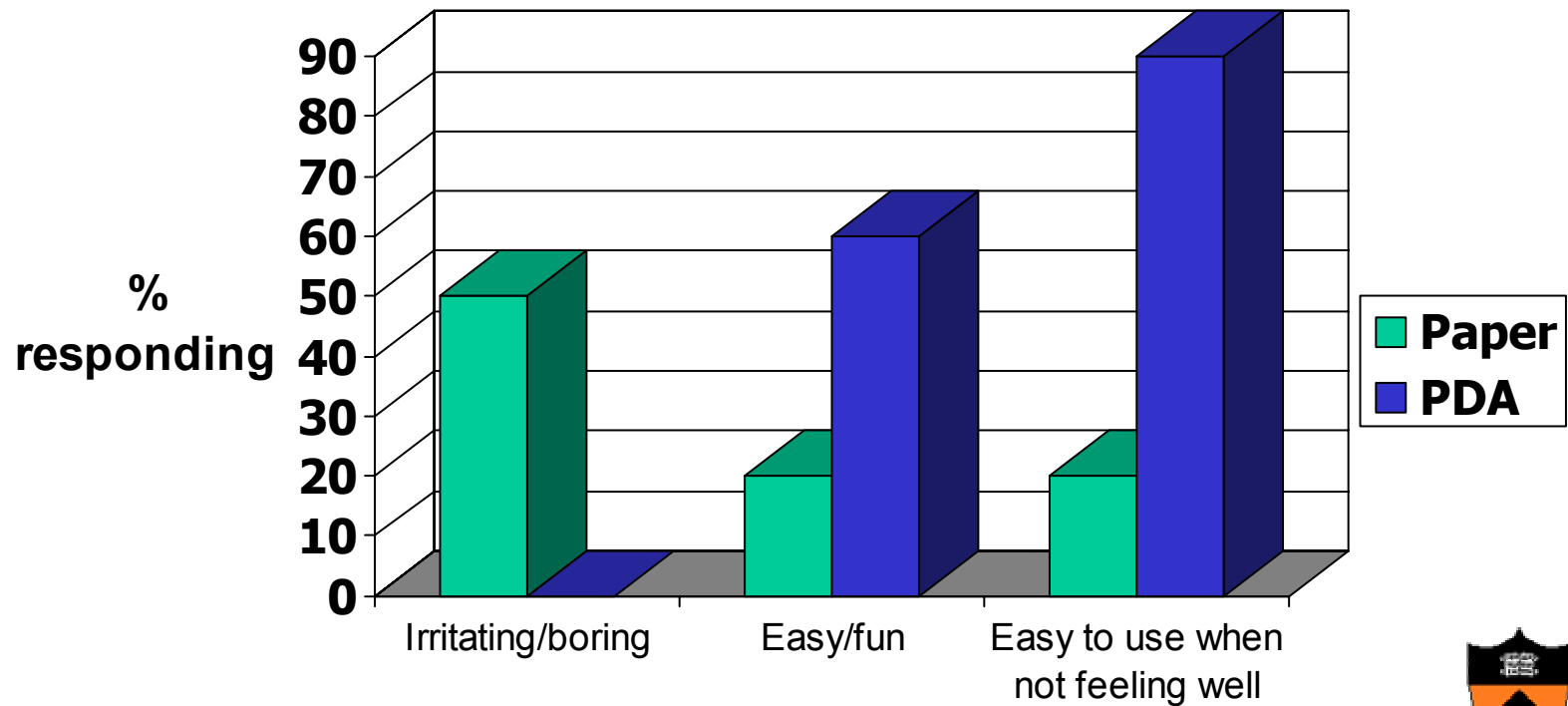




Peak flow values recorded by one patient (a) on paper; (b) electronically



PDA-based versus Paper-based Survey



Johnson KB, et al. Pediatrics, 1995



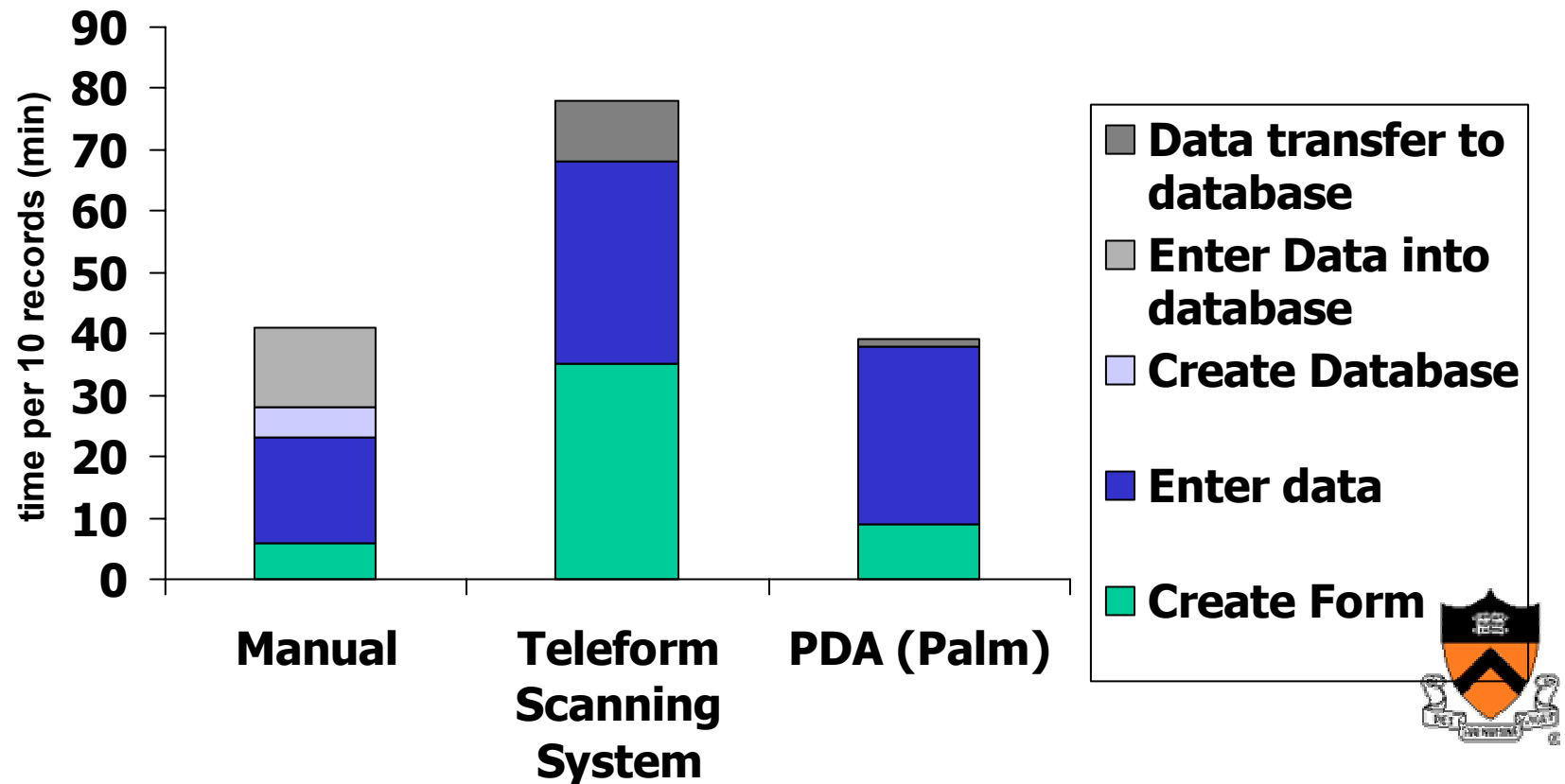
PDA-based versus Paper-based Survey

- PDA also significantly better for:
 - use by other teenagers
 - 7/10 said they would love it or think it was pretty good.
 - 7/10 paper users said others would not like their method
 - answering questions when not feeling well
 - 9/10--good or best way they could imagine
 - 2/10 paper users said good or best way they could imagine

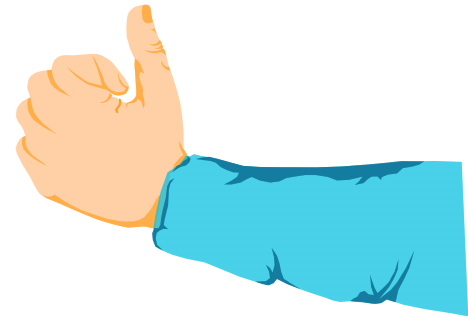


Choosing Technology to Support the Measurement of Patient Outcomes

Johnson,
CJ, Nolan MT, 1999



Overall Assessment



- In general,
 - Faster than paper, especially if complex surveys
 - High patient and provider acceptance
 - especially useful for codified entries
 - Overall expense lower than other solutions such as scanning forms! (PDA + app + training+ support)



Asthmonitor

- PDA-based implementation of Practice Parameter for outpatient asthma
- Allows data entry, printing
- Provides decision support at point of care
 - patient-specific
 - automatic



How Far To Go?

The Evidence Speaks

- Increased frequency of measured peak expiratory flow
- Increased administration of quick-reliever medications

BUT...

- No improvement in intermediate patient outcomes!

Shiffman RN, et al. Pediatrics 2000

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How can I use a PDA

- Types of Applications
- Solution Architecture



Handheld Applications

Administrative

- ✓ **Charge Capture**
- ✓ **Email**
- ✓ **Contacts**
- ✓ **File Cabinet**
- ✓ **Procedure Logs**

Clinical Information

- ✓ **Results**
- ✓ **Orders**
- ✓ **Medications**
- ✓ **Problem Lists**
- ✓ **Consults**

Reference and Tools

- ✓ **Drug Reference**
- ✓ **Formularies**
- ✓ **EBM Tools and Calculators**
- ✓ **Literature**
- ✓ **Research**



Architecture of Handheld Solutions

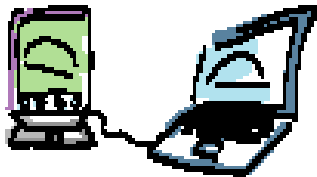


Always Connected

Often Connected



Occasionally Connected



Rarely Connected



Solution Architecture

Always Connected: PDA as a thin-client

- Requires always active wireless connectivity
- Useful Applications:
 - Order Entry
 - Real time monitoring
 - Lab Results viewing
 - Radiology Results viewing



The Wireless Revolution

- **Personal Area Network:**
 - Bluetooth 10-30 feet
- **Local Area Network:** 10-30 meters
 - IEEE 802.11
- **Wide Area Network:** Everywhere
 - CDPD Cellular Network (OmniSky, WAP I
 - Mobitex Pager Network (Palm VII)



Always Connected Solutions

- Approach taken by most existing HIS companies
 - Port existing web application
 - Most using 802.11 wireless standard
 - Not acknowledging that PDA's are different



Solution Architecture

Often Connected

- Frequently synchronized applications that can operate in a connected and disconnected modes
- Typically exist within the firewall of an enterprise
- Useful Applications:
 - Charge Capture
 - Lab Results
 - Medication Lists



Often-Connected Solutions

AvantGo: The Internet on your handheld

- Provides Palm, PocketPC and WAP Phone support for http based content and forms
- Free avantgo.com site allows configuration of public channels
- Enterprise server available for custom applications requiring security
- Advantage in leveraging existing http based infrastructure



Often-Connected Solutions

Middleware solutions from a variety of companies

- Proprietary server integrates handhelds, web and existing IS systems
- Services, Interfaces, Hardware, Training provided under a service contract
- Integrates to existing ADT, Billing, Lab systems
- Examples: PatientKeeper, MercuryMD, MedAptus



Solution Architecture

Occasionally Connected

- Connected once a day or less, typically via internet
- Used for information management tasks that don't change much in a day
- Useful Applications:
 - Charge Capture--MDEverywhere
 - Electronic Prescription Pads--AllScripts, ePhysician
 - References with update features (ePocrates)



Occasionally Connected Solutions

Automatically Updating Reference Companies



- 500,000 user network including 25% of all physicians
- “DocAlerts” push information to users PDA’s
- Free drug and infectious disease reference
- Will be providing automated Rx refill capability
- Users to earn honoraria (\$\$\$) by participating in marketing



- Subscription-based access to text-book references (e.g. The Merck Manual)



Solution Architecture

Rarely Connected

- Connected less than once per day, typically just for backup to PC or periodic upgrades
- Many freeware or shareware examples available online
- Examples:
 - References
 - EBM Tools
 - Medical Calculators
 - Stand-alone patient management applications



How do I create PDA software

- Palm
 - Metrowerks Codewarrior
 - Appforge for Visual Basic
 - Satellite Forms
 - Pendragon Forms
 - J-File, HanDBase
- Windows CE
 - MS Visual Basic, Visual C++



How should I design PDA software

- Sub-second response
- UI design for Pen
 - Don't let the pen obscure the screen
 - Most common controls in lower right corner (sorry lefties)
 - Minimize pen taps (3 tap rule)
 - Content/Functionality appropriate for device



Keys to Success in the Enterprise

- Integrate with *existing* Healthcare Information Systems
- One (and only one!) handheld, centrally administered
- Integrate applications with physician workflow
- Easy migration from wired to wireless environment (and back again...)



Learnings over the last 5 years

- PDA's are here to stay
- Size Matters--The Newton had everything Palm does and more but it took the Palm Pilot to jump start the market and the Palm V to make it really take off.
- People will adopt their style for the right device/functionality--Grafitti



Demo

- Reference Applications
- Medical Utility Applications
- EMR “Light” or PGMR (pretty good medical record)



Q&A



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