Mobile Healthcare: Applications, Vendors and Adoption

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Mobile/Wireless Healthcare
Conclusions (1 of 2)

• Big established enterprise healthcare vendors will beat small upstarts.
• There will be many converged mobile devices - some big, some small.
• View-only apps are easy - interactive apps are hard.
• Thin client apps are limited - thick client apps are better
• Wireless Local Area Networks are mature
• Wireless Wide Area Networks are adolescent
• Wireless Personal Area Networks (e.g., Bluetooth) are nascent
• Mobile/wireless is harder to secure than almost anything.
Mobile/Wireless Healthcare
Conclusions (2 of 2)

• Wireless Interference is a real problem but not a big problem
• Clinical content and calculator apps are a no-brainer
• Limited Computer-based Physician Order Entry on PDAs is OK
• Full CPOE is (too) tough
• Charge capture is a winner - but it’s a feature, not a product
• Return on Investment of mobile/wireless is real compared to paper
• Enterprise healthcare vendors have not gotten serious yet but will
On the Road to Mobile/Wireless Healthcare Value

Key Issues
1. What will be the winning form factors and networking technologies that will be used by healthcare professionals?
2. Which mobile healthcare applications will have the highest adoption and return on investment?
3. Which vendors will succeed in mobile healthcare?

Pilot now with upstarts, but eventually, primary vendors will provide the integration you need.
## Multiple Device Form Factors for Multiple Clinical Situations

<table>
<thead>
<tr>
<th>Situation</th>
<th>Form Factor</th>
<th>Bandwidth</th>
<th>Typical Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physician at the opera</td>
<td>Pager</td>
<td>Low (WWAN)</td>
<td>Alerts, notifications, confirmations, Rx refill requests, talk!</td>
</tr>
<tr>
<td>Physician making rounds</td>
<td>Smartphone</td>
<td></td>
<td>Prescriptions, charge capture, content lookup, dictation, e-mail, results viewing</td>
</tr>
<tr>
<td>Nurse making rounds</td>
<td>PDA</td>
<td>Med (WLAN)</td>
<td>Vital sign entry, medication management, charting</td>
</tr>
<tr>
<td>Physician/nurse/office worker at desk</td>
<td>Clamshell</td>
<td></td>
<td>Order entry, full chart review, advanced clinical decision support, scheduling...</td>
</tr>
<tr>
<td></td>
<td>Tablet PC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laptop</td>
<td>High (LAN)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Desktop PC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Breaking the Healthcare Input Bottleneck: ‘SuperGizmo!?‘

But it’s too heavy...

But I don’t have time to type...

But I don’t want to be encumbered by a mess of wires...

But I’m already carrying a cell phone and pager...

But I don’t have time to keep typing my password...

• Palm/Pocket PC form factor (or small tablet)
• Hand-printing recognition
• Speech recognition — continuous, large specialized vocabulary, medical language models, dictation
• Integral WLAN, WWAN, WPAN
• Bluetooth headset, keyboard and device synchronization
• Enhanced viewing screen (and heads-up display?)
• Digital wireless-phone/pager
• Digital camera and bar code scanner
• Internet microbrowser
• Cryptographic processing — becomes the token for digital certificates/private keys
• Biometrics for voice, signature & fingerprint scanning
• Position sensing/reporting
• Industrial strength housing
**Thick or Thin Mobile Clients? Can You (Should You) Have Both?**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Thick Client (cradle/synch. or intermittently connected)</th>
<th>Thin Client (microbrowser)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility</td>
<td>High*</td>
<td>Low-Medium</td>
</tr>
<tr>
<td>Performance</td>
<td>Medium-High</td>
<td>Depends**</td>
</tr>
<tr>
<td>TCO</td>
<td>Medium-High</td>
<td>Low</td>
</tr>
<tr>
<td>Security Reqrmts.</td>
<td>High</td>
<td>Low-Medium</td>
</tr>
<tr>
<td>Bandwidth Reqrmts.</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

* most-current information may not be available  
** depends on server and network latency
Mobile Device Integration/Access Alternatives for Healthcare

- Back-End/Legacy Applications
  - Poor: Application-Specific Device Integration
  - Fair: Enterprise Portal
  - Good: Multi-Channel Application Gateway (MAG)
  - Best: Portal with Integrated MAG

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## WLANs in Healthcare: A Little More Money, a Lot More Value

### What You Need
- Site survey (a few thousand dollars)
- Access points ($1,000 each, installed)
- Network interface card (< $100 each)
- Technical support (depends...)

### What You Get
- Ethernet speeds up to 11Mbps
- No running cables
- No need to adjust PC applications
- Compute power at point-of-care

### What You Need to Know
- Stick with 802.11b or 802.11a
- Use a VPN; plan for 802.11x
- Don’t mix WLAN vendors
- Plan for WLAN PDA battery drain

### Who to Buy From (examples)
- Cisco/Aironet
- Proxim
- Symbol
- Intel

### What Applications Make Sense
- Emergency department
- Admissions Discharge Transfer
- Medication mgmt. (with bar codes)
- Clinical decision support

### Who’s Doing It
- One-third of hospitals
- Two-thirds of IDSs
- Too many rogues!

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# Wireless WANs In Healthcare: Would Be Nice, But...

<table>
<thead>
<tr>
<th>Problem</th>
<th>Implications</th>
<th>Advice</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDAs still require clumsy add-on modems</td>
<td>Physicians won’t carry them</td>
<td>Upgrade to integrated wireless PDAs</td>
</tr>
<tr>
<td>Current bandwidth is too low</td>
<td>14.4Kbps supports limited applications</td>
<td>Use MAG to reformat to smaller screens</td>
</tr>
<tr>
<td>Cell phone ban in most hospitals</td>
<td>IS organizations don’t want to fight Biomed</td>
<td>Position facility into zones</td>
</tr>
<tr>
<td>Wireless coverage is lousy in most rural areas</td>
<td>Messages delayed, safety compromised</td>
<td>Use both thick and thin architecture</td>
</tr>
<tr>
<td>Too many standards</td>
<td>Look at geography</td>
<td>Go with dominant carrier</td>
</tr>
<tr>
<td>High wireless operator fees</td>
<td>Physicians won’t pay</td>
<td>Negotiate group rates and pool minutes</td>
</tr>
<tr>
<td>3G is still years away</td>
<td>Most strategies are overly optimistic</td>
<td>Plan on only 40-80 Kbps in 2003 and 2004</td>
</tr>
</tbody>
</table>
Is Wireless Interference Interfering With Your Wireless HC Goals?

- Patient Shaving
- 802.11a/b WLANs
- Bluetooth-Enabled Devices
- Poorly Shielded or Unshielded Medical Devices
- Various Transmitting Towers
- Ambulance Radios
- Cell Phones
- Baby Monitors
- Cafeteria Microwave Ovens

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Mobile Security: Don’t Rely On Defaults

**Bluetooth**
- Treat as completely insecure
- Use link encryption by default
- Use higher-stack security
- Test vendor offerings for security
- Add security in all critical apps.

**Devices**
- Treat unmanaged devices as intruders
- Enforce use of personal-device security tools
- Don’t store sensitive info. on the devices
- Purchase devices for the employees
- Turn on power-on password security

**WWANs**
- Use 3DS or Stronger Encryption

**WLANs**
- Turn on rudimentary 802.11b WEP security
- Use Virtual Private Networks
- Aim for more-secure single-supplier solutions
- Fortify mobile clients against attack
- Use wireless sniffer tools to hunt pirate APs
- Upgrade to 802.11i/802.1x in 2H03

**Synchronization**
- Replace synch. products every 2 years
- Install and lock synch. capability for users
- Manage synching centrally

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### Mobile Clinical Applications

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectivity</td>
<td>Cradled/synchronized</td>
<td>WLAN, WWAN, some Bluetooth</td>
<td>Broadband wireless</td>
</tr>
<tr>
<td>Applications</td>
<td>Reference, outpatient prescriptions, charge capture</td>
<td>Labs, some OE, alerts, eligibility/benefits checks, dictation</td>
<td>CDSS, more OE, benefits, referrals, clinical trials</td>
</tr>
<tr>
<td>Integration</td>
<td>PM, PBM, Pharmacy</td>
<td>Enterprise CPR, PM, lab, payer</td>
<td>Most systems</td>
</tr>
<tr>
<td>Interface</td>
<td>Keyboard, stylus, bar-codes</td>
<td>Limited speech, some handwriting</td>
<td>Speech/handwriting, glasses-mounted displays?</td>
</tr>
<tr>
<td>Adoption</td>
<td>200,000 physicians</td>
<td>350,000 physicians</td>
<td>500,000 physicians</td>
</tr>
<tr>
<td>Source</td>
<td>Healthcare PDA vendors</td>
<td>Leading Enterprise CPR/PM vendors</td>
<td>Almost all Enterprise CPR and PM vendors</td>
</tr>
</tbody>
</table>
# Mobile Pharmaceutical Applications

<table>
<thead>
<tr>
<th>User</th>
<th>Applications</th>
<th>Adoption 2003</th>
</tr>
</thead>
</table>
| Pharmaceutical Sales Rep | Sales force automation  
E-mail/calendar/PIM                                                            | High            |
| Physician             | Drug-drug interaction checker  
e-prescribing/formulary checking  
Product and safety information  
Participate in surveys/mkt. research  
Clinical trials data capture     | Low-Medium       |
| Nurse                 | Medication management                                                      | Low             |
| Patient               | Clinical data capture  
Content viewing                                                             | Low             |
Estimated ROI of Mobile Computing

<table>
<thead>
<tr>
<th>Wireless/Mobile-Based</th>
<th>Early Vendor-/User-Claimed ROI</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td>Save (Lose?) 1.5 hours/day?</td>
</tr>
<tr>
<td>Charge Capture</td>
<td>Capture 10%-30% more encounters?</td>
</tr>
<tr>
<td>Prescription Writing</td>
<td>Save up to one hour per day and reduce errors by more than 50%?</td>
</tr>
<tr>
<td>Lab Report Viewing</td>
<td>Reduce certain patient-type length-of-stay by one day?</td>
</tr>
<tr>
<td>Ambulatory Suite</td>
<td>Save two hours per day per physician?</td>
</tr>
</tbody>
</table>

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The Fight for Healthcare Mobile Marketshare

Established Enterprise Healthcare Vendors
(e.g., McKesson, Cerner, Eclipsys, Epic, Siemens, WebMD/Medical Manager)

Telecom Carriers
(e.g., AT&T, Verizon)

PDA-based Healthcare Application Vendors
(e.g., Allscripts, MDeverywhere, ePocrates)

Healthcare-Focused
PDA-based Infrastructure Vendors
(e.g., PatientKeeper, MercuryMD, MedAptus)

Medical Device Companies
(e.g., GE, Medtronic, Spacelabs)

Wireless Application Gateway Vendors
(e.g., Aether, AvantGo, Air2Web)

Integration Brokers
(e.g., Sybase/Neon, SeeBeyond)

Healthcare Vertical Portals
(e.g., HealthVision, WebMD)

Pharmacy Benefit Mgmt Systems
(e.g., Caremark, AdvancePCS)

Pharmaceutical Companies
(e.g., J&J, Pfizer)

Payers
(e.g., Pacificare)
Who Will Own the Physician Interface In a Heterogeneous IDS?

View only? View and update?

PatientKeeper? MercuryMD? Many others…
Or...
Your primary enterprise healthcare vendor?
Mobile/Wireless Application Vendor Evaluation Criteria: Vision

1) Functionality (e.g., medical content, e-prescribing, charge capture, lab report viewing, others) in ambulatory and acute care settings

2) Architecture and Delivery, such as thin and thick client models, read-only and data capture/interactive applications, synchronization and security approaches

3) Integration with back-end and legacy systems such as CPR, lab, PM, ERP, PBM, payers

4) Support for multiple operating systems (e.g., PocketPC, Palm), networks (WLAN, WWAN, WPAN) and mobile device form factors (e.g., smartphone, PDA, tablet PC).
Mobile/Wireless Application Vendor Evaluation Criteria: Ability to Execute

1) Number and types of users (e.g., adoption by physicians, nurses and other mobile clinical professionals)

2) Strength and breadth of marketing/sales channels and partnerships to reach prospects

3) Number and experience of dedicated professionals to mobile/wireless healthcare development, implementation, customer service and support

4) Overall company funding, financial viability and performance (e.g., vendor’s track record)
Mobile/Wireless Healthcare Application Magic Quadrant

Challengers

Leaders

Niche Players

Visionaries

Ability to Execute

Completeness of Vision

As of October, 2002
## Case Study: NYS Office of Mental Health

<table>
<thead>
<tr>
<th>Problem</th>
<th>Support mobile case workers with up-to-date information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Application</td>
<td>Connection to medical record apps. and charge capture</td>
</tr>
<tr>
<td>Additional Apps.</td>
<td>PIM; street and subway maps; physician desk reference</td>
</tr>
<tr>
<td>Hardware</td>
<td>Initially Compaq iPaqs with two-slot sleds and large battery</td>
</tr>
<tr>
<td>Wireless Approach</td>
<td>WWAN using Verizon and Sprint</td>
</tr>
<tr>
<td>Security</td>
<td>Passwords + signature + SecurID + encrypted drives</td>
</tr>
<tr>
<td>Pilot:</td>
<td>Phase 1: 20 users; Phase 2: 40 additional users</td>
</tr>
<tr>
<td>Development Costs</td>
<td>$150,000 to reach pilot phase in 12 weeks</td>
</tr>
<tr>
<td>Partners</td>
<td>Compaq (provided primary development)</td>
</tr>
<tr>
<td>Target Rollout</td>
<td>More than 1,000 users by 2003 - many using tablet PCs</td>
</tr>
</tbody>
</table>
Recommendations

• Plan for multiple-device form factors to meet multiple needs.
• Buy mobile devices with integrated wireless.
• When implementing a wireless application, build the wireless LAN infrastructure around IEEE 802.11b.
• Don’t depend on high-bandwidth WWAN for the next few years.
• Lift/relax the cell phone ban (establish wireless-enabled zones).
• View mobile/wireless as a major new security threat.
• Pilot/Implement PDA-based content access, charge capture, prescription writing and lab report viewing now.
• Expect the established enterprise CPR/PM vendors to be the eventual winners in delivering mobile solutions.