“Mobile Health in the U.S. Army: The Power of Virtualizing Healthcare”

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National Network for Telehealth
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Disclaimer

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Military Health System

- US Military Health System- $43B global health system serving over 9.8 million beneficiaries.
- Interested in telemedicine & mHealth as a mechanism to preserve and promote health and ensure soldier fitness.
The Propagation of Mobile Technologies

- 6 billion mobile phone subscribers worldwide. (ITU, Nov 2011)

- Mobile data networks cover 90% of the people on the planet.

- 60% of the world’s population can access fast mobile connections (HSDPA/3G+).

- On average, your mobile phone is within an arm’s reach 19 hours per day.

- Majority of new internet connections worldwide are mobile.
Mobile phones – then and now!
Adult gadget ownership over time (2006-2012)

% of American adults who own each device

Obama administration is calling for government services to get on the mobile bandwagon.

Digital Government Strategy initiative - President Obama directed all government agencies to make at least two of their "priority customer-facing services" available on mobile devices within the next 12 months.

Each agency is to create a web page outlining its digital strategy within two months and use web performance analytics & customer satisfaction measurement tools on all ".gov" websites.

Data.gov site will be transformed into a data and API catalog that pulls directly from agency websites in real time to encourage more outside development.
Current data shows that doctors are supportive of mHealth

- 88% of physicians would like their patients to track or monitor their health at home, particularly their weight, blood sugar levels and vital signs.
- 56% of physicians using mobile devices say they expedite decision-making.
- 67% of physicians say they are using personal mobile devices for health solutions that aren't connected to their practice or hospital IT systems.
- Doctors are 250% more likely to own a tablet than other consumers.

Mobile Health Applications Flooding Marketplace
## Mobile Health Applications

<table>
<thead>
<tr>
<th>Application</th>
<th>Number of health applications available for download</th>
<th>Intended for consumer / patient</th>
<th>Intended for healthcare professional</th>
<th>Number of downloads</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPhone</td>
<td>~6000</td>
<td>73%</td>
<td>30%</td>
<td>Unknown</td>
</tr>
<tr>
<td>Android</td>
<td>~600</td>
<td>81%</td>
<td>20%</td>
<td>3.5 million +</td>
</tr>
<tr>
<td>Blackberry</td>
<td>~200</td>
<td>70%</td>
<td>30%</td>
<td>Unknown</td>
</tr>
</tbody>
</table>
What is mHealth?

- mhealth is the use of mobile and wireless devices to improve health outcomes, healthcare services and health research.

-This definition was developed by a NIH Consensus group
Smoking Cessation: 28% of smokers receiving SMS messages quit vs. 13% of control group. (A. Rogers et.al. Do u smoke after txt? Tobacco Control 2005;14:255-261).

Diabetes: For patients using interactive SMS support service, mean HbA1c improved from $7.5 \pm 1.5\%$ to $7.0 \pm 1.1\%$ ($P = 0.003$). Hyuk-Sang Kwon, et. al. Diabetes Research and Clinical Practice Volume 66, December 2004: Pages S133-S137.

Diabetes: The web-based intervention using SMS messaging improved levels of HbA1c in type-2 diabetic patients for the six-month duration of the trial. Journal of Clinical Nursing, June, 2007, Vol. 16 No. 6, pp 1082-1087 Hee-Seung Kim, Ph.D., RN; Hye-Sun Jeong PhD, RN.

Wireless Body Area Network (wBAN) using “Smart” bandages

Athletes
Diagnosis
Obese
Elderly
Chronically ill
Industrial
Military

EKG
Heart Rate
SPO₂
Hydration
Temperature
etc.

BAN Medical Patches as smart disposable labels.

Standardized, detachable, re-usable radio
First Clinical Trial
Low Cost, Easy to Deploy Health Gateway
Low Cost, Easy to Deploy Health Gateway
Qualcomm 2net concept
Key Mobile Health Capabilities

- Mobile Learning
- Medical Imaging
- Web Services
- Telemedicine
- Social Networking
- Electronic Health Record (EHR) Integration
- Physiological Monitoring & Telemetry ("Smart Bandages")
- Secure Messaging
- Outcome Based Metrics
Can mHealth Fill in the “White Space”

Typical patient has 4 - 30-minute Medical Appointments/year

555,600 minutes in a year
TATRC Mobile Health Domains

Mobile Health

**Theater**
- On the Move (OTM) linkage to fixed medical facility (COPs/FOBs)

**Garrison**
- Patient Centered Medical Home (PCMH)
- Pain / Behavioral Health
- Warrior Transition Command

**Global**
- Supporting COCOM
- Open Source software
- Medical Stability Operations
- Humanitarian Assistance/Disaster Response (HA/DR)
TATRC Mobile Health Domains

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- Clinic/Hospital Home
- Patient Centered Medical Home (PCMH)
- Pain / Behavioral Health
- Warrior Transition Command

Global
- (International)
mCare: Mobile Secure Messaging for the Case Management of Injured Soldiers
“mCare” : Mobile phone-based Secure Messaging System for the Case Management of Injured Soldiers

- Synchronization over distance of:
  - Wounded Warriors (mTBI)
  - Military care team members

- Uses patients’ EXISTING cell phones

- Secure, HIPAA compliant messaging

- Simple patient responses (typically 1 character or one click)

- Care team leverages a website to access information
mCare Message Utilization from Launch Date

277,069
mCare Charting

Cell phone user feedback accessed through the web portal dashboard
Patient Case Study

Typical Monthly Messages (February 2012)
Appointment Reminders 13 (7 specialties)
Announcements 14
Health & Wellness Tips 20
TOTAL 47
# mCare Research Study

- Prospective, randomized, two arm, placebo controlled, IRB approved trial
- \( n=184 \)
- Completion date: October 2012

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Objective</th>
<th>Measurement</th>
<th>Expected Benefit</th>
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</thead>
<tbody>
<tr>
<td>Administrative</td>
<td>Increasing contract rates</td>
<td>Contact rates assessment btw SM, CM and PS</td>
<td>Improvement contact rates</td>
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<tr>
<td></td>
<td>Satisfaction with CM Care</td>
<td>Management Quality Assessment</td>
<td>Increased communication = increased satisfaction</td>
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<tr>
<td></td>
<td>Appointment attendance rates</td>
<td>Rates of verified appointment attendance</td>
<td>Decreased no-show rates</td>
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<tr>
<td>Clinical *</td>
<td>Well-being / Neurobehavioral</td>
<td>General Well-Being Schedule, Neurobehavioral symptom Inventory</td>
<td>Evaluation of current symptoms</td>
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<tr>
<td></td>
<td>Goal awareness</td>
<td>Comprehensive Transition Plan assessment</td>
<td>Accurate goal awareness</td>
</tr>
<tr>
<td>Technological</td>
<td>System performance</td>
<td>System analysis</td>
<td>Prioritization of features required</td>
</tr>
<tr>
<td></td>
<td>System utilization – Service Member</td>
<td>System analysis</td>
<td>System is functional and reliable</td>
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<tr>
<td></td>
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<td>System is functional and reliable</td>
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<tr>
<td>System-based</td>
<td>User Satisfaction – Service Member</td>
<td>Focus group evaluation QUIS technology assessment</td>
<td>Acceptability of system</td>
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Text4Baby

SMS messaging to promote maternal-fetal health
Text4Baby

First ever **free-to-end -user mobile** health information service taken to scale in the US.

**Educational program** of the National Healthy Mother Healthy Babies Coalition focused on maternal & child health.

Allows women to receive timely information via their personal mobile phones - **keeps them informed on ways they can improve their health & the health of their babies**

**Three SMS text messages per week** through pregnancy & the first year of life timed to due date or baby’s date of birth.

>150,000  **women (and men)** enrolled since 4 Feb 2010 and
>11 million **messages** sent

http://www.text4baby.org
Text4Baby Evaluation Summary

• TATRC sponsoring evaluation of text4baby at Madigan Army Medical Center with GWU assisting in the evaluation (December 2011 start date)
• Randomized controlled trial with approximately 1,000 pregnant active personnel & dependents
• Comparing: text4baby + usual care with usual care
• Powered to detect improved pre-natal care utilization (PNCU)
• Hypothesis: Text4baby will promote PNCU & pre-natal healthy behaviors targeted by text messages:
  – smoking, alcohol consumption, immunizations, folic acid & vitamin consumption
• Enrollment: 428 enrolled as of 22 May 2012
• Four Surveys for each study participant
Concept of Operations (CONOPS) for the Army Medical Department

Mobile Health Environment (MHE)
Scope: Inclusive of 4 Domains

- Mobile interactions:
  - Patient to Provider
  - Patient to System
  - Provider to Provider
  - Provider to System
TATRC Mobile Health Domains

Mobile Health

Theater - (Tactical)
- On the Move (OTM)
- OTM linkage to fixed medical facility (COPs/FOBs)

Garrison
- Patient Centered Medical Home (PCMH)
- Pain / Behavioral Health
- Warrior Transition Command
- Medical Management Center (MMC)

Global - (International)
- Supporting COCOM
- Open Source software
- Medical Stability Operations
- Humanitarian Assistance/Disaster Response (HA/DR)
Exploring ways to issue soldiers cell phones and pay the monthly bill – for use both in garrison & deployed settings.

Goal is for soldiers to get information when they need it, wherever they are.

“One of the options potentially is to make it a piece of equipment in a soldier’s clothing bag.”

Lieutenant General Michael Vane,
Director, Army Capabilities Integration Center, on issuing cell phones to soldiers.
“Combat Smart Phones”
Casualty Treatment Data Capture

Tactical Combat Casualty Care (TCCC) Card

Name/ID: ____________________________

DTG: ____________ ALLERGIES: ____________________________

Friendly Unknown NBC

A: Intact Adjunct Cric Intubated
B: Chest Seal NeedleD ChestTube
C: TQ Hemostatic Packed PressureDx

IV IO

FLUIDS: NS / LR 500 1000 1500
Hextend 500 1000

Other:

DRUGS (Type / Dose / Route):
PAIN
ABX
OTHER

GSW BLAST MVA Other ____________

TIME
AVPU
PULSE
RESP
BP

Medic’s Name ____________________________
Combat Casualty Care Informatics & Telemedicine – First Responder Medic

- Ruggedized User Programmable Cell Phone
- Medical Devices
  - Physiological Monitor (Tempus IC)
  - Voice recorder
- Tactical Radio
- Modem
- MC-70 with AHLTA-M
- Insertable Programmable chip cards
- Ultra-Wide Band Electronic Information Carrier
TATRC Mobile Health Domains

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Global
- Garrison/Clinic/Hospital Home
- (Tactical)
- (International)
Mobile Learning Environment (MoLE)

Using Smartphones to enhance Humanitarian and Disaster Relief Operations
Military Health Support for “Stability Operations”
(May 17, 2010)

- Required development of specialized training – new course to teach “Medical Stability Operations” (i.e. MSOC) to support Humanitarian Assistance and Disaster Response.

- Ideal candidate for exploring mobile delivery of content and tools given newness of material and remote nature of those who will likely need it.
Assessment of mLearning Trends - DoD

September 14, 2009

M-Learning definition:
“Mobile learning (m-learning) is defined in this report as training, educational, or job-specific content that can be accessed, viewed or created from a mobile device.”

mLearning Recommendations:
• Look at “moments of need” rather than courses.
• Do not present mobile learning as a training program, but rather as a productivity tool.
• Design content for mobile. Bulk conversion is not effective.
Mobile Learning Environment Project

Coalition Warfare Program

*Goal:* Conduct research & development with foreign partners to enhance interoperability and *unclassified* information-sharing.

*Project Objective:* Develop a prototype mobile capability to support military medics (US and partner) deployed on humanitarian or disaster relief operations.

Not on .mil network/using personal Smartphones. Learning content to integrate with other back-end learning management systems.

Address language and culture gaps.

Twenty-two countries participating.

Mobile Learning Environment (MoLE) Project
Global Medical Aid for Humanitarian Assistance/Disaster Relief
Prototype App- Global MedAid

**Mission Tools:**
Checklists
Health Assessments

**Library:**
Publications
eBooks (NGO guide)
Video interviews (USAID)

**Standards:**
Code of Conduct
Geneva Convention
Sphere Handbook
Informed consent

**Learning:**
CTIP (Combating Trafficking In Persons) course
Medical videos (Univ. of Miami)
MoD wellness
NGO recognition activities

**Mission Packs:**
Different culture / destination / language packs to download (inactive for PoC)

**Network:**
Lookup: Collaborative Yellow Pages
Developing underpinning capability

Mobile Content

App Software

Hardware

SYSTEM- WIDE INFRASTRUCTURE

Distribution, Curation, Management
Live international trials ongoing

Proof of Concept Trials currently in progress
- Several app stores
- Private (own) devices
- Multiple languages
- Range of professions and skill levels

Goal: 600 volunteers in 26 nations
- 260 have already started
- Complete: September 2012

Innovative “in app” evaluation allows for remote trialling
Trial Connect

SMS messaging to enhance outreach to vaccine trial patients
Sanofi Pasteur - Trial Sponsor
- Pharmaceutical company developed vaccine for dengue

MRMC-AFRIMS - Overseas Lab
- US-Thai Military medical research partnership assisting with vaccine trial administration
- Mahidol University and BioPath-research contractors employing clinical teams

MRMC-TATRC (Sponsor)
- US Army medical technology research center contributing Health IT expertise

Dimagi Inc.
- Health-technology company developing TrialConnect
TrialConnect
Use of Mobile Phones to Enhance a Phase III Dengue Vaccine Trial in Thailand & Philippines

• Operational Challenges
  – Demanding protocol – 3 years in duration
  – Large distributed cohorts of research volunteers
  – Communication challenges
  – Traditional methods involve community-based follow-up: expensive and inconsistent

• Goals
  – Improve operational efficiency, volunteer compliance and enhance volunteer and staff engagement using mobile phones.

• Research objective (s)
  – Design and implement an SMS (text) service called “TrialConnect”
  – Evaluate impact on a variety of factors
  – Implement in a way that avoids jeopardizing the integrity of the clinical trial.

Mobile penetration
Philippines ~80%
Thailand ~100%
SMS is #1 in mobile messaging
TrialConnect

A mobile solution

A secure, HIPAA-compliant SMS system for:

Volunteer Protocol Compliance

- Staff → Patient Messaging (Informational)
- Patient → Staff Messaging (Help Requests)

Organization and Logistical Support

- Staff → Staff Messaging (Organizational)
- Automated Messaging (Cold Chain)

Participant Engagement

- Automated Appointment Reminders with Confirmation
- Health Tips
- Holidays & Special Events

Using mHealth as a Force Multiplier
TrialConnect in Use
TrialConnect
Technology

- 100% Open source, built on RapidSMS
- Easy to use authoring tools for messages, reminder schedules, etc.
- Modular design allows for new features to be added from RapidSMS community such as:
  - Logistics tracking (CommTrack)
  - Polling & surveys
  - Medication & adherence reminders
- Easy integration with 3rd Party systems
- Product approach to maximize re-use
  - All features were built to be configurable through an administration interface
TrialConnect
Focus Group Exercises

Community

Study Staff

Stakeholders
TrialConnect

Status - 1 January 2011

• Deployed at 2 sites
  • Cebu City, Philippines
  • Kamphaeng Phet, Thailand
• 1500 patients currently enrolled
• Staff-Staff messaging in use
• Appointment reminders active
• Broadcast messaging soon

Cebu staff introducing prospective participants to the study
4 refrigerators for Vaccine storage

ICS probes inside of all refrigerators/freezers
SMS on the phone when Alarm Alert

SIM Number in the server Will send SMS to Logistician 1, 2 and Head of KAVRU. If the 1st person not response by reply SMS back to the server then it will send SMS out to next person again every 5 min.
Kids getting enrolled into the trial in Cebu.
Mobile Health Critical Challenges

1. Integration of mobile applications with legacy information systems - Electronic Medical Records (EMR)
2. Information overload to providers – how best to manage?
3. Support for a variety of handheld devices (e.g., iPhone, Droid, Blackberry) & a variety of network connections (e.g., 802.11 Wireless Local Area Network (WLAN)/Wi-Fi, Bluetooth Personal Area Network (PAN), wireless broadband Wide Area Network (WAN), Ultra Wideband (UWB));
4. Security, privacy & confidentiality of patient data on the handheld and during transmission
5. FDA impact – mobile phone vs. medical device? - Role is evolving
Challenges in mHealth Implementation

Bi-directional data pull “to” and “from” the EHR
Summary

- US Army has a global mobile health presence and an extensive R&D portfolio.

- US Military mobile health solutions are all applicable to a civilian setting.

- Innovations in wireless are influencing all aspects of our lives.

- Mobile health is the future of Telemedicine and will continue to grow as the research outcomes will hopefully demonstrate.
Questions?

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