An Update on Telemedicine Capabilities to Deployed U.S. Forces

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&
Telemedicine Consultant for the US Army Surgeon General
Topics to cover

- U.S. Based Tele-Consultation capabilities
- OIF/OEF Tele-Consultation capabilities
- Deployable Teleradiology System (DTRS)
- Lessons Learned
- Business Strategy/Critical Issues
- Conclusions
Spectrum of Tele-consultation Capabilities

- Two way voice – telephone or radio.
- Store-and-forward – the ability to exchange medical knowledge asynchronously using:
  - FAX
  - E-mail text
  - Email with small size image attachments
  - Email with data & large size image attachments in compressed form, such as motion picture (MPEG), digital pathology (JPEG) or digital radiography (DICOM)
- Web-based education & teaching systems (streaming video & multimedia education formats)
- Real-time Video-teleconferencing (VTC)
Army Medical Department Investment in Telehealth

• World-wide deployed capability
  – Radiology (>70 DICOM servers)
  – Pathology (22 systems) linked to the AFIP
  – Ophthalmology (LRMC, WRAMC, TAMC)
  – Dermatology

• Medical Center (MEDCEN) expertise
  – Landstuhl Regional Medical Center, Landstuhl, Germany
    • Radiology – support to Europe and SW Asia
  – Brooke AMC, San Antonio, TX
    • Dermatology – 500 consults /month
    • Cardiology – 300 Echo’s/month
  – Tripler AMC, Honolulu, HI
    • Pediatrics – 30 consults/month
    • eICU consults with Guam Naval
  – Walter Reed AMC, Washington, DC
    • Psychiatry – 200 consults/month
    • Neurosurgery – 277 consults in last 16 months
Army Knowledge On-line (AKO)
Remote Consultation Programs

- Army based Email system with JPEG image attachments – no patient identifying information
- Interim solution until Tele-radiology hardware can expand to support other clinical specialties (i.e. Dermatology, Ocular, Infectious Disease)
- Utilizes theater providers personal digital camera & routine AKO email
- U.S. based medical specialists answer email with JPEG images 24x7
- Response time: < 5 hours (average for more than 1400 consults)
- Strong favorable response from deployed providers and involved U.S. Army Medical Consultants
- Policy approved (March 2005) for adding additional specialties (approved 10 May 05 - pediatrics, nephrology, burn/trauma)
Army Medical Department
Policy for use of E-mail Tele-consultation for Deployed Providers

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY MEDICAL COMMAND
2050 WORTH ROAD
FORT SAM HOUSTON, TEXAS 78234-6000

REPLY TO ATTENTION OF

DASG-IMD

OTSG/MEDCOM Policy Memo 05-004

17 MAR 2005

Expires 17 March 2007

MEMORANDUM FOR DIRECTORS, OTSG/MEDCOM OneStaff

SUBJECT: Use of Army Knowledge Online (AKO) Email in Support of Electronic Telehealth Medical Consultation by Deployed Providers
Deployed Telehealth Applications in Operation Iraqi Freedom (OIF) & Operation Enduring Freedom (OEF)

**High Bandwidth – requires dedicated bandwidth**
Radiology
VTC – Psychiatry & Surgical mentoring (Neurosurgery/Tele-dialysis*)
(pending availability of bandwidth)

**Low Bandwidth - email with JPEG images**
Dermatology
Ocular
Infectious Disease
Cardiology
Pediatric Intensive Care (PICU)
Nephrology
Burn/Trauma
Toxicology
Dental
Pathology – all consults to AFIP

**Dedicated 2-way voice**
Post-operative surgical management
Remote Consultation Using AKO & Outlook E-mail

Referring provider logs into AKO and submits consult.

Referring provider receives answer via AKO email.

Consult Manager receives teleconsultation request.

AKO email automatically routed to Outlook Exchange Server.

A Consultant Group receives the teleconsultation request.

Consultant Manager sends email.

Consultant receives email and responds.

Email automatically routed to Outlook Exchange Server.

Referring provider receives answer via AKO email.

LDAP distribution list.
## Tele-consultation Specialty Summary

<table>
<thead>
<tr>
<th>Specialty</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>Program Consults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burn-Trauma</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dermatology</td>
<td>26</td>
<td>60</td>
<td>43</td>
<td>73</td>
</tr>
<tr>
<td>Infectious Diseases</td>
<td>2</td>
<td>2</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Nephrology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Pediatrics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toxicology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>26</td>
<td>60</td>
<td>43</td>
<td>62</td>
</tr>
</tbody>
</table>

% of Total Consults: 77%
International Tele-consultation Summary

- 181 Consults received - from 18 nationalities including foreign military, detainees, non-combatants, and foreign contractors

- 11 Consults received from foreign Physicians supporting US and Multi-national Operations

<table>
<thead>
<tr>
<th>Non-U.S. Referring Physicians</th>
<th># of Consults</th>
<th>Non-U.S. Patients</th>
<th># of Consults</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Army</td>
<td>1</td>
<td>Afghanistan Non-Combatants</td>
<td>39</td>
<td>Iraqi Air Force</td>
</tr>
<tr>
<td>Australian Navy</td>
<td>2</td>
<td>Australian Army</td>
<td>1</td>
<td>Iraq Army</td>
</tr>
<tr>
<td>Hungarian Army (MFO Sinai)</td>
<td>8</td>
<td>Australian Navy</td>
<td>2</td>
<td>Italian Navy</td>
</tr>
<tr>
<td>Bosnian Child</td>
<td></td>
<td>Korean Army</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bosnian Officer</td>
<td></td>
<td>Kyrgyzstan Contractor</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>British Soldier</td>
<td></td>
<td>Nepalese Contractor</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Columbian Army</td>
<td></td>
<td>Pakistan</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Dutch Army</td>
<td></td>
<td>Saudi Detainee</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Fijian Contractor</td>
<td></td>
<td>SE Asian (not specified)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hungarian Soldier</td>
<td></td>
<td>South Africa Contractor</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>India Army</td>
<td></td>
<td>Sri Lanka Contractor</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>India Contractor</td>
<td></td>
<td>Turkey Contractor</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Iraq (Civilians &amp; Detainees)</td>
<td></td>
<td>Ugandanian Army</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
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</table>

Total: 181
## Program Summary

### By Location of Referring Physician

<table>
<thead>
<tr>
<th>Location of Referring Physician</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>Program Totals</th>
<th>Consult %</th>
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</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bosnia</td>
<td>4 6 15</td>
<td>1 2 1</td>
<td>3 5 7</td>
<td>152</td>
<td>3%</td>
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<tr>
<td>Chad</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>0.1%</td>
</tr>
<tr>
<td>CONUS</td>
<td>3 1 6</td>
<td>2 3 5</td>
<td>2 2 1</td>
<td>25</td>
<td>2%</td>
</tr>
<tr>
<td>Diego Garcia</td>
<td>-</td>
<td>1 0 1</td>
<td>-</td>
<td>-</td>
<td>0.1%</td>
</tr>
<tr>
<td>Egypt (MFO)</td>
<td>1 1 5</td>
<td>1 3 1</td>
<td>3 5 2</td>
<td>29</td>
<td>2%</td>
</tr>
<tr>
<td>Germany</td>
<td>1 1 2</td>
<td>4 1 1</td>
<td>1 1 1</td>
<td>12</td>
<td>1%</td>
</tr>
<tr>
<td>Honduras</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>0.1%</td>
</tr>
<tr>
<td>Iraq</td>
<td>14 36 32 39 31 45</td>
<td>27 22 26 20 32 42</td>
<td>53 77 57 28 44 45</td>
<td>923</td>
<td>63%</td>
</tr>
<tr>
<td>Italy</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>0.1%</td>
</tr>
<tr>
<td>Korea</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>0.1%</td>
</tr>
<tr>
<td>Kuwait</td>
<td>11 17 6 13 10 7</td>
<td>9 11 6 2 6 6 1 1 5 4</td>
<td>4 5 5 1 6</td>
<td>136</td>
<td>9%</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>-</td>
<td>2 1 2</td>
<td>2 0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Okinawa</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>0.1%</td>
</tr>
<tr>
<td>Pakistan</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>2.8%</td>
</tr>
<tr>
<td>Qatar</td>
<td>1 1 1</td>
<td>3 5 4 5 4 1 4 2</td>
<td>9 4 5 3 3 1</td>
<td>56</td>
<td>4%</td>
</tr>
<tr>
<td>US Navy Afloat</td>
<td>1 1 1 9 4</td>
<td>1 2 1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Not Stated</td>
<td>1 5 3 5 3 2 3 1 2</td>
<td>1 1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>26 60 43 62 61 79</td>
<td>51 40 42 23 39 67 84 108 74 52 70 74</td>
<td>64 103 75 50 45 75</td>
<td>1,467</td>
<td>-</td>
</tr>
</tbody>
</table>
# Program Summary

## By Patient Branch of Service

<table>
<thead>
<tr>
<th>Patient Branch</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>Program Total</th>
<th>Program %</th>
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<tbody>
<tr>
<td>Air Force</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>117</td>
<td>8%</td>
</tr>
<tr>
<td>Army</td>
<td>24</td>
<td>51</td>
<td>33</td>
<td>851</td>
<td>58%</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>139</td>
<td>9%</td>
</tr>
<tr>
<td>Navy</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td>29</td>
<td>2%</td>
</tr>
<tr>
<td>Contractor</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>51</td>
<td>3%</td>
</tr>
<tr>
<td>Detainee</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>27</td>
<td>2%</td>
</tr>
<tr>
<td>Non-Combatant</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>125</td>
<td>9%</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>45</td>
<td>3%</td>
</tr>
<tr>
<td>Not Stated/NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>83</td>
<td>6%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>26</td>
<td>60</td>
<td>43</td>
<td>1,467</td>
<td></td>
</tr>
</tbody>
</table>
Kuwait MTF

MC4 Communications & Deployable Teleradiology System (DTRS) Stack
DTRS Functional Capabilities

Intra-hospital, file sharing – image distribution is essential to the standard of care, efficiency and workflow requirements.
• Inter-hospital, archiving/consultative interpretation

• Inter-hospital, archiving/diagnostic interpretation
# Teleradiology in Kuwait and Iraq

First 6 Months Workload  
(Computed Radiology & Computed Tomography) in CY 2005

<table>
<thead>
<tr>
<th>Kuwait Referring Site</th>
<th># Exams</th>
<th># Images</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp Buehring</td>
<td>264</td>
<td>792</td>
</tr>
<tr>
<td>Camp Arifjan</td>
<td>488</td>
<td>1464</td>
</tr>
<tr>
<td>Camp Ali Al Salem</td>
<td>24</td>
<td>72</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Iraq Referring Site</th>
<th># Exams</th>
<th># Images</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balad</td>
<td>14,220</td>
<td>42,660</td>
</tr>
<tr>
<td>Mosul</td>
<td>15,570</td>
<td>46,710</td>
</tr>
<tr>
<td>Baghdad</td>
<td>15,150</td>
<td>45,450</td>
</tr>
</tbody>
</table>

- Most Telerad interpreted in theater, however, some at Landstuhl.  
- 40% images sent prior to MEDEVAC patient arrival at Landstuhl.
**Tele-Dentistry in OIF2 Theater**

- Widely deployed in OIF2 theater

- **Clinical uses:**
  - Tele-consultation
  - Human remains ID
    (Panorex sent to Dover AFB)

- Averaging 10-15 consults/week in Baghdad
Telepathology

- Currently, telepathology consultation used approximately one to two times per week on average depending on the case load and difficulty of cases.

- 48 cases (CY05) - use has increased now that it has become a more user-friendly & efficient diagnostic tool.

- Telepathology consultative reports usually received the next business day.
Telemedicine Measures of Effectiveness

- Relevant in GWOT
  - Improved access to specialty care (demonstrated in all specialties)
  - Avoided or facilitated medical evacuations due to second opinion consult
  - Elevation of the quality of care by allowing rapid multi-specialty consultation (i.e. Infectious Disease & Dermatology)
  - Improved optimization of medical resources (Consult management in Theatre)
- Cost-savings by avoiding out-sourcing care to the civilian sector (i.e. cardiac ECHO)
- Continuity of care by providing longitudinal medical imagery collected at deployed MTF’s (i.e. Radiology) & forwarded to Level IV/V MTF’s
- Telemedicine is becoming a part of how we deliver care
Operational Lessons Learned

• E-mail with JPEG image attachments works well
  – Digital cameras are common in theater
  – Requires minimal bandwidth
  – No training requirements needed to implement

• Erosion in use of telemedicine equipment occurs as new units rotate into theater.
  – Need to identify & train replacement units before they deploy
  – Frequent communications with deployed units on their clinical tele-consultation need is essential.
Technical Lessons Learned

• “Expect the Unexpected’
• Electrical power
  – 110 volt vs. 220 volt
    • 220 volt organic to unit
    • Need to have equipment able to run on either voltage
  – Interrupted power supply – unpredictable
• Bandwidth availability is rate-limiting resource in theater
• Network security vulnerabilities
  – Personal PC’s on military network
  – Unanticipated computer virus’ on network
Administrative Lessons Learned

• Establishing official policy on use of telehealth facilitates user acceptance in theater (providers & commanders)
• Marketing capabilities with an official “Campaign Plan” is invaluable.
• An assigned Signal Corps (communications) liaison officer assisting the Medical Command with bandwidth needs for theater hospitals is critical.
• Consult Manager is invaluable in routing and referring complex cases
US Army Medical Department
Pakistan Earthquake Relief

- 7.6 Richter scale earthquake on 8 OCT05
- 30 km NW of Muzaffarabad, Pakistan
- Over 85,000 lives lost
- 212th MASH from Germany arrived 19 OCT 05 to provide humanitarian assistance
## Summary

### Pakistan Earthquake Mission, 212th MASH, Muzaffarabad, Pakistan

<table>
<thead>
<tr>
<th>Month</th>
<th>1st Consultant</th>
<th>2nd Consultant</th>
<th>Consultant’s Diagnosis</th>
<th>Consults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct</td>
<td>BT</td>
<td>PICU</td>
<td>Fracture advise</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>ID</td>
<td>Tetanus</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Japanese Encephalitis</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Nov</td>
<td>Derm</td>
<td>PICU</td>
<td>Drug reaction v scabies v Staph</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arthropod Assault</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Atopic Dermatitis v Psoriasis</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bacterial Infection</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bullous Impetigo</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Dermatitis</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fungal</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lichen simplex chronicus</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Psoriasis</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rosacea</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>BT</td>
<td>PICU</td>
<td>Severe trauma: earthquake casualty</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cerebral Palsy and Meningitis</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meningitis</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bacterial Meningitis</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diptheria</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>H Pylori Infection</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pregnancy with Typhoid</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tetanus</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td>ID</td>
<td>BT</td>
<td>ARDS with Ascaris</td>
<td>1</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Vulvar Necrotising Fascitis</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>PICU</td>
<td>Cards</td>
<td>Peiodic Bradycardia, Sepsis, Diarrhea</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pneumonia</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Total:** 27

BT: Burn Trauma  
Cards: Cardiology  
Derm: Dermatology  
ID: Infectious Diseases  
PICU: Pediatrics Intensive Care
Dermatology Consults from Pakistan

13 yo female with h/o recurrent facial rash, consistent with contact dermatitis – followed with serial digital images
9 yo Pakistani male with extensive psoriasis
December Case Studies

Referring Physician's Narration

I have a 40 yo AD Marine Staff Sargent who has what appears to be a 3 mm verruca along the lash line of his left eye.

He states that he first noticed it 3 weeks ago. His corpsman originally believed it was an external hordelum, and instructed him to put warm compresses on it for 10 min, three times a day. There has been no drainage, and it has grown in size. It is cauliflower-like, and indurated on palpation. He does not have verruca anywhere else on his body. It does not interfere with his vision, but is irritating.

I would appreciate your opinion on the best way to handle this lesion.

Dermatologist's Recommendation / Dx

Appears to be a verruca.

I think a snip bx is the best treatment for this area. Followed by cryosurgery with LN2 or a combination of both.

The topicals are all too irritating to the epithelium of the eye (unless they have a new one)

Would recommend ref to Baghdad for ophthalmology (or the next higher if not available) for the bx and confirm with histology for SCC is in the DDX.

Ophthalmologist's Recommendation / Dx

I like to shave these off using some eyelid clamps which protect the eye. We can see him here.

Consult Number: 0544051215
Dx/DDx: Verruca
Hurricane Katrina Support

- **Dermatology**
  - Allergic Contact Dermatitis
  - Bacterial v Folliculitis

  ✔ Collaboration with Infectious Diseases

- **Infectious Diseases**
  - Use of Cipro for evacuees
  - Management of military exposed to contaminated flood waters
Integration Strategy with DoD HIS (AHLTA)

Longitudinal EMR developed and fielded

FY05 | FY06 | FY07 | FY08 | FY09 | FY10 | FY011

AHLTA - CDR

Leverage Interim Operating Capabilities

Current Tele-Radiology Platform

Application Layers

Teleconsultation

Dermatology

Medical Education (e-Learning)

Ocular
Mental Health
Orthopedics
Dental
Cardiology

Leverage existing Teleradiology infrastructure
To accelerate interim solution

Interim

WEB USER

MTF

Internet

A fully telehealth enabled organization-integrated with AHLTA, TOL, MEDIA, EWRAS, EWS

Future

Integrating Experience

Full Operating Capability
Conclusions

- Remote consultation is actively providing mission & cost benefits.

- Telehealth is now a set of individualized capabilities but should be one entity & integrated into the DoD HIS.

- Dedicated Bandwidth is the rate limiting resource for operational telehealth – requires General Officer & Signal Corps support.

- Measurable levels of effectiveness for Telehealth has been demonstrated in deployed facilities.

- Tri-service use among deployed providers is supported & encouraged

- TMA systems require consolidation and coordination to insure “one system – one view”