IT Challenges for Space Medicine

Kathy Johnson-Throop
NASA Johnson Space Center
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Outline

- What Space Medicine does
- IT Challenges
- Some Solutions & Questions
Space Medicine Activities

- Lifetime Surveillance of Astronaut Health
- Mission medical support
- Occupational health services
- Clinical Laboratory
- Pharmacy
- Radiation Health
- Behavioral Health and Performance
- Data repositories:
  - Clinical Data
  - Human Research Data
- And more . . .
Private Medical Information

- Applicable Legislation
  - Privacy Act of 1974 as amended
  - Health Insurance Portability and Accountability Act

- Regulations call for:
  - Secure storage
  - Secure transmission
  - Access only by authorized personnel
Lifetime Surveillance of Astronaut Health

- Secure systems: Electronic Medical Record System (11 yrs), Clinical Laboratory System
- Secure interfaces: External reference labs send data back to Clinical Laboratory electronically
- Remote access/Secure transmission (physician): Records are requested from physicians not associated with NASA (e.g. PCP for retired astronaut)
- Remote access/Secure transmission/Data rich interface (astronaut): Electronic update of medical history & other questionnaires
Mission Medical Support

- Uptime - on call 24x7, continuity of operations during disasters
- Backups: off-region storage
- Remote Access: flight surgeon’s home, JSC, KSC, Star City, Kazakhstan, etc.
- Foreign National Access
  » Much pre-, in-, and post-flight medical testing is done at JSC
  » Need to provide access to medical information
- Rapid credentialing: in the case of a medical contingency, the expertise needed may not have a NASA affiliation already, yet need to transmit medical information very quickly and securely
Data Repositories for Research

- **LSAH-R** = data repository containing astronaut data under the 10HIMS system of record which includes clinical data collected during routine health care, medical requirements during a mission, and occupational health surveillance data.

- **Life Sciences Data Archive** = data repository containing human research data under the 10HERD system of record which includes both ground and flight experiment data on astronauts and other human subjects.
Data Input

- Remote Access and Credentialing
  - Some data is collected in ground-based research facilities (e.g. bed-rest)
  - Accurate, timely data is best facilitated by direct entry of data into NASA systems
  - Nurses & other personnel are employed by the research facility – numerous personnel due to shifts, turnover, etc.
Data Output

- Remote Access – data in the repositories can be requested by researchers, usually in support of a research grant.
- Foreign national access – many research personnel are foreign nationals
- Secure Transmission/Protection of information
  - The informed consent that subjects signed may enable access to attributable data (able to be associated with a single person)
  - Astronaut flight data is particularly attributable even when no names are used – many variables identify a limited number of individuals such as the number of days in flight, gender, and some ages
Finding Data/Information

- Data standards – regular encoding of data is required to ensure that a complete set of data is pulled in support of research requests
- Efficient search for information – searches often return too many non-relevant items
Summary of Challenges

- Protect Private Medical Information
  » Secure Storage
  » Secure Systems
  » Secure Transmission
- Remote Access
- Foreign National Access
- Uptime/Backups
- Credentialing
- Data Standards
- Search
Some Solutions & Questions
Secure Transmission

- Entrust
  » Agency resource – low overhead
  » Blackberries can use
  » Does not work with International Partners

- PGP
  » Works with International Partners
  » Requires additional overhead (key management)

- Kryptiq
  » Secure messaging system associated with the JSC Electronic Medical Record (EMR)
Secure Storage

- Store within applications (e.g. EMR)
- Store centrally where possible (Space Medicine servers)
  » Side benefit = limits risk of data loss
- Encrypt when stored on local machine
Secure Systems

- Standard suite of solutions
  - 2-Factor Authentication
  - Intrusion Detection
  - Regular updates
  - Regular scanning of systems
  - Training on protecting private medical information in SATERN: JSC-SA-PPCMD Protection, Privacy, and Confidentiality of Medical Data
Remote Access

- VPN
- Terminal Server
  » EMR and other Space Medicine IT services available
  » Limits local storage of data
  » Mitigates issues with some programs timing out: EMR will lock a record if a transaction takes too long
Uptime/Backups

- Disaster Recovery Site
  » Virtualized Servers
  » Active synchronization
- Off-region backup
Data Standards

- **SNOMED**
  - Standardized NOmenclature for MEDicine
  - Nearly complete terminology for coding medical data: Diagnoses, symptoms, procedures
  - Federal standard for healthcare terminology
  - Hierarchical Categories, multiple relationships = rich ability to pull information. E.g. All diagnoses of kidney disorders
Data Standards

- MeSH
  » Medical Subject Headings
  » Controlled vocabulary for indexing, cataloging & searching biomedical and health-related information and documents
  » http://www.nlm.nih.gov/mesh
Messaging Standards

- HL7
  - Health Level 7
  - International/Federal standard for health messaging
  - http://www.hl7.org
Search

- Working with JSC search group – added a subset of MESH terms to indexing service
- Exploring concept-based search
  » Set of concepts define the search
  » More relevant search results than keyword-based search
  » Particular product used is Collexis
    • Creates a “fingerprint” of concepts and their strength of representation for each document
    • Can be used to also index a person’s expertise based on the documents associated with them
Foreign Nationals

- International Partners – try to anticipate needs and get them the credentials they need to do their work
- Researchers at US universities – currently working through the lengthy process to get NASA credentials
  » Is there a better solution to give them access to just the data that they need for their research?
Credentialing

- Researchers – currently working through the process to credential all (in the past they had a separate account)
  » Same question as foreign nationals: Is there a better solution to give them access to just the data that they need for their research?
- Research Facility Personnel
  » Question: Is there a solution to give them access to enter data into NASA systems without generating credentials for all the personnel at a facility?
Discussion

There is a tension between protecting the information in our systems and providing the access needed.

Ideas are welcome!