IT Challenges for Space Medicine

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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

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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
  - » http://www.cap.org/apps/docs/snomed/sts/index.html

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SNOMED Coding Tool

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?

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Discussion

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

Ideas are welcome!