

National Aeronautics and Space Administration



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

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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

The banner features a vertical gradient from dark purple at the top to green at the bottom. It includes abstract space-themed graphics such as a bright sun or star with radiating lines, several overlapping circles, and a grid pattern.

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Some Solutions & Questions

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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

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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>

SNOMED Coding Tool

Participant Summary | LSAH SNOMED Coding Tool

LSAH SNOMED Coding Tool

Text to Code
Fractured right ankle

Expression Builder

- Confirmed Diagnosis
 - Fracture of ankle (disorder) : 16114001
 - Associated morphology
 - Fracture
 - Finding site
 - Bone structure of ankle

Concept Search
Searching for: Fractured right ankle
Filter: Clinical Findings

Search 39 matches found

Search Text: Words (any order)
fracture ankle

- Fracture dislocation or subluxation ankle
- Fracture malunion - ankle and/or foot
- Fracture malunion - ankle/foot
- Fracture of ankle
- Fracture subluxation of ankle joint
- Open fracture ankle, bimalleolar
- Open fracture ankle, bimalleolar, high fibula
- Open fracture ankle, bimalleolar, low fibular

Concept Walker

- Fracture of lower limb (disorder)
 - Fracture of bone (disorder)
 - Injury of lower extremity (disorder)
 - Injury of anatomical site (disorder)
 - Disorder of lower extremity (disorder)
 - Traumatic injury (disorder)
 - Traumatic AND/OR non-traumatic i
 - Disease (disorder)
 - Clinical finding (finding)
 - SNOMED CT Concept (SN)

Fracture of ankle (disorder)

- Closed fracture of ankle (disorder)
- Fracture dislocation of ankle joint (disorder)
- Fracture of distal end of tibia (disorder)
- Fracture of ankle, NOS (disorder)
- Fracture of talus (disorder)
- Open fracture of ankle (disorder)

Concept Details

- Descriptions
 - Fracture of ankle (disorder)
 - Fracture of ankle
 - Ankle fracture
 - Fracture of distal end of tibia and fibula
- Properties
 - SNOMED CT Code: 16114001
 - Concept Status: Current
- Fully defined by...
 - Is a
 - Injury of ankle (disorder)
 - Fracture of lower limb (disorder)

Delete Selected Tree

Close

Build Expression

Key: ● - Preferred Term ■ - Attribute
* - Synonym ▲ - Property

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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!