Translational Research in Space Exploration

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Space Flight poses special health challenges

- Musculoskeletal: Loss of muscle and bone mass
- Systemic: Fluid shifts within torso
- Vestibular system: Vertigo, nausea
- Radiation effects
- Others

NASA: A pioneer in translational research

- Due to necessity, NASA long has been engaged in expeditiously applying fundamental lab research to devices, medications, training, and countermeasures.
- Evidence from space travel → Compiled → Analyzed → Develop equipment, Medications, Countermeasures → Test terrestrially → Implement and fly on mission → Evidence from new mission
- In the last few years the Medical Informatics and Health Care Systems Branch at NASA Johnson Space Center has been systematizing this process with the assistance of computing technologies.

Evidence-based technologies enable translation

- Need to apply from analog environments and health care knowledge-bases
  - National Health Information Network
- Perform meta analysis and combine data from multiple sources
- Standardized coding methodologies can enable combining data into complete and consistent databases
  - SNOMED is a focus of interest

Applying terrestrial medical research

- Terrestrially the standard of care is evolving
- At NASA we are interested in two kinds of analog environments
  - Analogs with constraints on mass, power, volume, personnel, training
  - Physiological and clinical analogs, sometimes specially designed experiments such as bed-rest studies
- Adapt R&D in these environments and insert or leverage these early into the requirements process so that a product adapted for space travel can be easily developed, e.g. Lightweight Trauma Module
- The military is a great source for these kinds of analogs
- Both Hardware (devices, sensors), and also Software-intensive appliances

R&D at NASA also supports terrestrial healthcare

- NASA has long tradition of translating products developed for spaceflight into products that are useful terrestrially
- In healthcare, two examples:
  - GuideView technology, originally developed as a just-in-time medical procedure assistant for long duration space flight, can be adapted easily to terrestrial environments wherever physician density is low.
  - Use of ultrasound for non-traditional imaging. E.g. pursue ability to use ultrasound for diagnosis of bone fracture and retinal detachment. NASA focusses on ultrasound for spaceflight because it has better MPV factors than equipment used terrestrially (X-rays, MRI). But this technology adaptation is equally useful terrestrially to support remote-care and telemedicine