Medical Education: The world has changed
Consequences to Space Medicine Education
From immersion to post grad training

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Medical education

• 1834 Medical College of Louisiana
  – University of Louisiana
  – Tulane University of Louisiana
  – Lectures several times a week
  – 2 days a week with patients @ Charity Hospital

• 1888 Tulane University post graduate medical education
  – Surgery
  – Medicine
  – Obstetrics
  – Pediatrics

• “Intern” because they were ‘interned’ in the hospital
• “Residents” because they lived in the hospital
Medical education

- Immersion/apprenticeship
  - Resident learned all there was to be learned

**Resident expected to know all there is to know about medicine**

- No time for marriage or other diversions
and along came Libby Zion
• **Supposition**
  – Resident too tired to care for the patient

• **Real Cause**
  – Patient died because of poor hand off
  – Possible laziness

• **Possible contributing factors**
  – Lack of HO organization
  – Make bad decisions based on poor information

• **Continuity of care is important**
Behold

**********
The 80 hour work week
New Rules of Education

• 80 hours per week in the care setting
• After 24 hours, spend 6 hours of handoff
• Turn off beeper & telephone for 10 hours
  – No communication with patient, hospital or other residents
• One day off in 7
• In-house call 1 in 3 maximum
Consequences

• The continuity of patient care
  – risks associated with HO performance
  – Tired
  – Attention diverted
  – Studying

• Adequate rest and sleep are very important

• Shift medical care
  – “factory assembly line”
  – Perhaps not the best way to assure the patients receive the standard of care and the best environment for training of HO’s
  – Continuity of care is lost
    • Don’t write everything down
    • Thought process is loss leaving only the decision
Time out
Let’s think
How can we use these rules to win

Physicians have been at this business for more than 6000 years. Continuity of care has been a cornerstone of the best physicians had to offer their patients.

Question
How shall we continue to develop physicians that are capable of providing outstanding medical care even under the most adverse conditions?
Core Competencies

- Patient care
- Medical Knowledge
- Interpersonal and communication skills
- Professionalism
- Practice-based learning and improvement
- Systems-based practice

AC Graduate Medical Education
The American Board of Medical Specialists
Post Graduate Education Model

- Defined outcome requirements
- Consistent education within institution and between institutions
- Objectives to meet the outcome needs
- Clinical education with patients (80 hour week)
- Extra didactic education (in addition to 80 hours)
  - Skill training labs
  - Defined reading material
  - E-learning
Post graduate educational principles
Adjusted for the clinical environment

• Interactive learning
  – prior knowledge
  – clinical experience

• The interactive => understanding

• Understanding not knowledge alone
  – correct judgments
  – therefore good decisions
Post graduate educational principles
Adjusted for the clinical environment

• Interactive learning cannot occur without prior knowledge
• More prior knowledge => better understanding
• Prior knowledge
  – Life experiences
  – Reading
    • Textbooks
    • Journal articles
  – E-learning
“80 hour work week”

- Prior surgical training = **immersion** educational process
- New Process = **Structured** educational process
  - Knowledge acquisition
    - Nights & weekend study time
    - Text book study
    - Journal reading
    - E-learning
  - Knowledge integration
    - 80 hours in hospital
    - Operating room
    - Clinics
    - Bedside patient care
    - Teaching rounds
    - Small discussion groups
Educational objectives

- Each rotation/each year
- Cognitive objectives
- Behavioral objectives
- Review with staff
  - Beginning of rotation
  - Teaching along the way
  - End of the rotation
- Acquisition of knowledge is the residents responsibility
- Assistance and guidance is the staff responsibility
- Integration is everybody’s responsibility
New Educational Strategy

• 80 hour work week is for clinical education
• Behavioral
  – OR
  – ED
  – Patient care floors
  – ICU
• Cognitive education
  – Clinical services
    • Clinical wards
    • Surgery clinics
    • Small inter-active conferences
    • Q&A sessions in OR
  – Morbidity & Mortality
  – Grand Rounds
• Off duty
  • Reading
  • E-learning
New Educational Strategy

- American Board of Surgery
- Association of Surgical Program Directors
- Surgery Residency Review Committee
- Association of Surgical Chairman
- Summer 2004
The New Educational World and Space Medicine
Relationship to NASA and Medical care in orbit and long durations missions
Educational working groups

>60 reviewers over 5 years

- **Backgrounds of the reviewers**
  - Surgeons - PreHospital care
  - Internists - Educators
  - Critical care physicians - Hyperbarics
  - Emergency medicine - Toxicology
  - Astronauts - Flight surgeons
  - Anesthesia

- **Charged to analyze the current medical care providers education**

- **Make recommendations for revisions and future long duration flights**
Extramural Findings

Current limitations to initial and sustainment training may result in care providers who are not properly prepared to carry out the clinical responsibilities with which they have been charged, i.e., inadequate fund of knowledge and skills to carry out clinical tasks.

Flight Surgeon sustainment training is insufficient to address the new Maintenance of Certification requirements.

In most cases, severe limitations to sustainment training have resulted in the current group of astronaut physicians’ inability to maintain their clinical skills and knowledge.

The evidence base for the practice of Space Medicine is very limited and is a current constraint.
In order for NASA to have a competent and certified group of space medicine providers, i.e., flight surgeons and physician astronauts, the training requirements of medical boards must be met to include:

### General Competencies

- Medical knowledge
- Patient care
- Interpersonal and communication skills
- Professionalism
- Practice-based learning and improvement
- Systems-based practice
Recommendations

- Enhance the existing CMO training process
- Flight surgeon sustainment educational processes
  - CME,
  - skills enhancement,
  - space life sciences research.

Astronaut physicians and Physician astronauts
  - Define duties
  - develop an ongoing educational process
  - Develop required skills and the knowledge base.

- Exploration Mission
  - Define the conditions
  - Design a training program for Space Surgeon
  - Implement the training process

- Clinical research program
  - Identify deficiencies
  - Develop program
  - Implement process
Recommendations Continued

NASA must assure that the flight surgeons and physician astronauts meet these requirements.

Maintenance of Certification (MOC)* requires that the physician must be assessed in these four categories:

- Cognitive Expertise
- Life Long Learning
- Professional Standing
- Practice performance

*As defined by The American Board of Medical Specialists
Recommendations Continued

Provide training opportunities to enable initial space medicine training and sustainment of that training for all categories of providers.

Should include terrestrial opportunities in clinical settings and possibly in remote and hostile environments.

Coordinate training efforts with International Space Station (ISS) Partners and search for collaborative approaches.
Five levels of providers

- Crew Medical Officer
- Flight Surgeon
- Astronaut Physician
- Physician Astronaut
- Space Surgeon
  - Long durations missions
  - No Resupply
  - No return
Space Medicine Providers

Ground
Flight Surgeon

Flight
Space Surgeon ➔ Mars
Physician Astronaut ➔ Moon ➔ ISS
Astronaut Physician ➔ Shuttle
Crew Medical Officer

Missions
Rational for change
Crew Medical Officer (CMO)

- Current medical training ~45 hours
  - Terrestrial analog for similar duties ~ 300 hours

- Current skills should include
  - Assessment
  - Ophthalmologic
  - BVM ventilation & Endotracheal intubation
  - Intra Venous access
  - IM & PO medications
  - Defibrillation

- Very limited sustainment training
- Minimal medical simulator sustainment training
- Skill and Knowledge Sustainment testing?
- No Just-in-time (JIT) training available
Requirements for Training
Crew Medical Officer

• Assess knowledge & skills requirements
  – medical conditions to be encountered
  – conditions under which such care will be provided
• Develop educational objectives to meet these needs
• Define reading & study materials
• Develop clinical educational opportunities
• Develop scenario based education
• Develop sustainment education
• Develop competency based testing methods
  – Oral
  – Simulation
  – written
Recommended Educational blueprint

Crew Medical Officer

• Phase I
  – Basic Science
  – ASCAN education
  – 40 hours

• Phase II
  – Advanced CMO training
  – Skills & knowledge of most likely used techniques
  – Proficiency required
  – Scenario, lab, simulator, clinical

• Phase III
  – Mission specific
  – One on one with flight surgeon
  – 33 hours

• Phase II
  – Just in time (JIT) or orbit
Rational for change

Flight Surgeon

- Current job specific training - Limited
- Education & training required for hire – MD/DO
- Sustainment training – CME
- Medical simulator training – None required
- Skills update – None required
- Clinical patient care – Limited
- Skill and Knowledge Sustainment testing - None
Requirements for Training Flight Surgeon

- Review and revise job description
- Update entry requirements for future flight surgeons
- Sustainment education
- Clinical patient care in ED
- Periodic testing to assure competency
  - Oral
  - Simulation
  - written
Educational Blue Print
Flight Surgeon

- 20% of time
- Clinical
  - ED
  - OR
- Simulator
  - Practice orbital emergencies
- Skills
  - Animal lab
  - Simulator
  - ED
  - OR
Rational for change

Space Surgeon

• Knowledge & Skills required
  – Those of a general surgeon of 50 years ago
  – Update to current knowledge
  – Biomedical equipment maintenance & repair
  – Psychological counseling
Requirements for Training
Space surgeon

- Assess
  - potential medical diseases
  - Conditions under which these must be treated
- Develop educational objectives
- Define educational needs
- Assess educational opportunities
- Entrance requirements (TBD)
  - Board certification
    - Surgery
    - Emergency medicine
- Other education needed to complete the skills & knowledge requirements
- Continued practice in skills learned
- Continued education & training as an astronaut
- Periodic testing to assure competency
  - Oral
  - Simulation
  - written
Requirements for Training

Space surgeon

- Review of potential conditions to be encountered
- Develop relationships with various educational institutions for bridge courses as needed
- Other education needed to complete the skills & knowledge requirements
- Continued practice in skills learned
- Continued education & training as an astronaut
- Periodic testing to assure competency
  - Oral
  - Simulation
  - written
Educational blueprint

Space Surgeon

• **Skills & knowledge needed**
  – Surgical
  – Emergency medicine
  – ENT
  – Ophthalmologic
  – OB/GYN
  – Orthopedic
  – Neurosurgical
  – Psychiatric
  – Biomedical

• **Entry level determines the educational program**

• **Continued clinical experience during astronaut and mission specific training**
Space Surgeon

Next step

• Finalize & polish job description
• Educational objectives
  – Behavioral
  – Cognitive
• Finalize curriculum
• Develop educational plan
  – Initial education
  – Sustainment education
• Establish training sites
• Select Physicians for training
• Initiate training process
  – Initial
  – Sustainment
•Credential the Space Surgeons
Summary

• The education of physicians has changed
  – Initial
  – Ongoing (Sustainment)

• NASA obligations to update
  – CMO
    • Update the job description
    • Develop defined educational objectives
    • Restructure the process
    • Sustainment educational plan
    • Periodic testing
    • Upgrade skills & knowledge before fight
Summary

NASA obligations to update

• Flight Surgeons
  – Job description
    • Clinic activities
    • Console activities
  – Sustainment education
    • National meetings
    • Clinical updates
      – Job related clinical training
    • ATLS
    • ACLS
    • PALS
    • CME
Summary

NASA obligations to update

• Physician Astronauts
  – Job Description
  – Sustainment educational plan
    • Clinical
    • CME
    • testing
Summary

NASA obligations to update

• Space surgeon
  – Recognize the need
  – Develop the job description
  – Development the educational process
  – Commitment to implementation