



Transition of Research into Medical Practice

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Transition to Operations (TtO) Process

Research

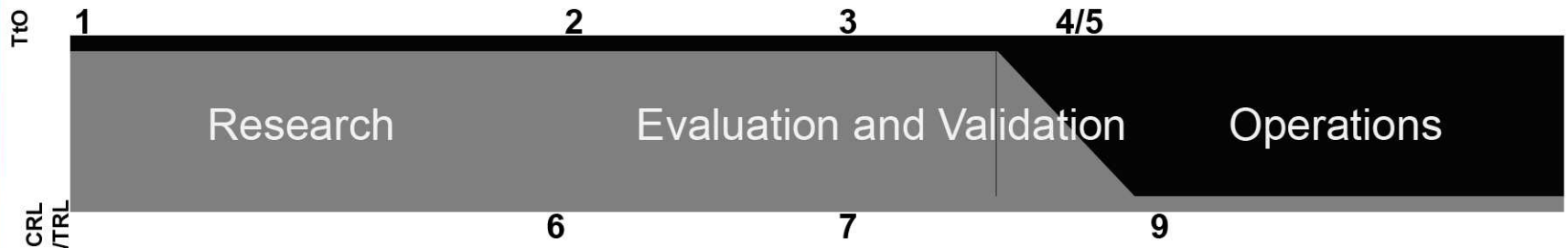
Evaluation and Validation

Operations

- Objectives
 - Apply best practices for space exploration
 - Evaluate the effectiveness and operational readiness of human health-related research and technology products and deliverables
 - medical research and technology products and deliverables
 - environmental factors research and technology products
 - human factors & habitability research and technology products
 - Support Agency human space flight programs
- Scope: newly proposed health and medically related procedures, practices, processes, countermeasures, or technologies.



Transition to Operations Steps



1. Description of deliverable/product
 - detailed description
 - intended use or application
 - how it addresses a NASA identified critical risk, medical issue, or application
2. Data required to demonstrate efficacy, effectiveness, or utility of deliverable/product
3. Data required to demonstrate the operational validation of the deliverable or product
4. Implementation plan to describe the product/deliverable use or application (e.g. protocol, dosing regime, scope of use, etc.).
5. Analysis of mission resources required for product/deliverable implementation (e.g. crew time, volume, power, etc.)



Bone QCT Example

- ✓ TtO1: DEXA scans provide an assessment of bone density, but does not capture sufficient information to assess risk of fracture.
- ✓ TtO2: Ground studies showed Bone QCT is an indicator of bone strength; showed that strength is regained along the axes of bone that bear load, but not along the less loaded axes. Fracture risk increases for some situations (unquantifiable increase).
- ✓ TtO3: Flight study verified ground-based results.
- TtO4/5: QCT may become a medical requirement.
- Note, the quantification of the increased risk of fracture remains unknown. *This aspect is still a research question.*



Actigraphy Example

- ✓ TtO1: Crews sleep poorly in space and this has the potential to affect their ability to work. How do we assess this?
- ✓ TtO2: Terrestrial medicine uses actigraphy to diagnose sleep disorders and as an outcome measure for treatment.
- TtO3: Flight study in progress. Results thus far show that in-flight data can be used in a similar way..
- ☐ TtO4/5: Actigraphy may become an assessment technique used by flight surgeons to determine sleep quality and treatment effectiveness.

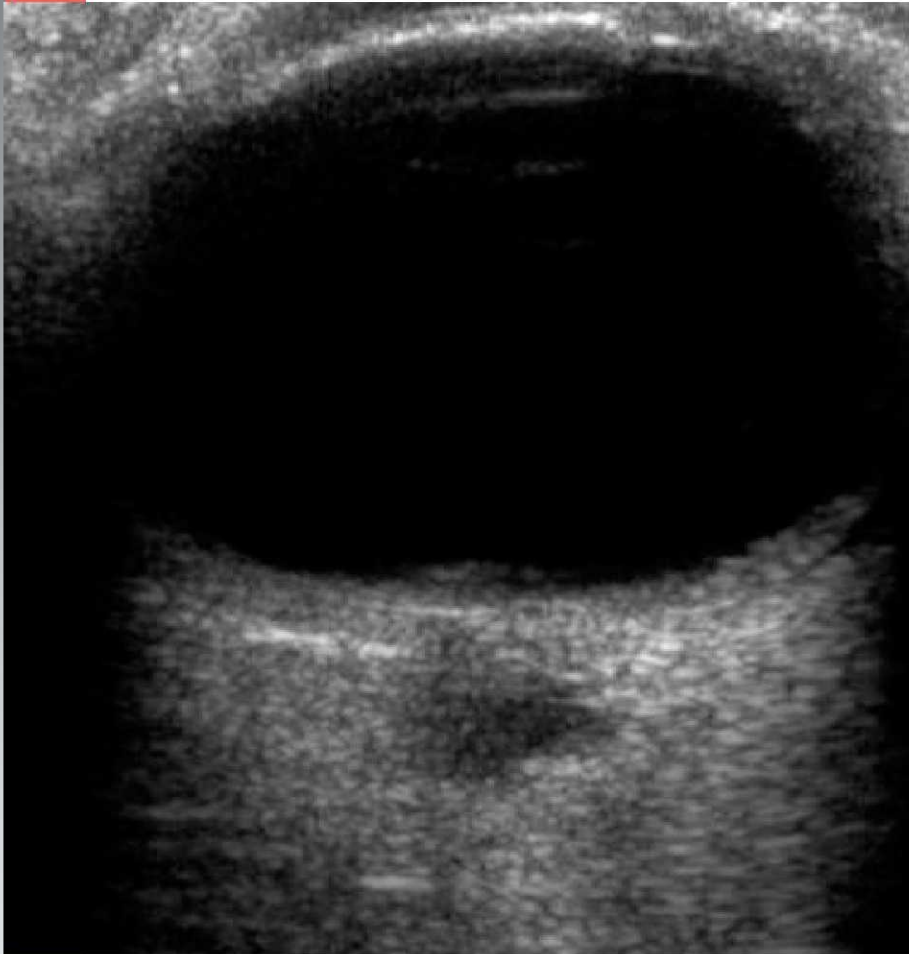


Potassium Citrate Example

- ✓ TtO1: Kidney Stones are a risk .
- ✓ TtO2: Ground studies showed . . .
- ✓ TtO3: Flight study verified ground-based results.
- TtO4/5: Potassium Citrate may become a countermeasure used to lessen the risk of kidney stone formation.



Ultrasound



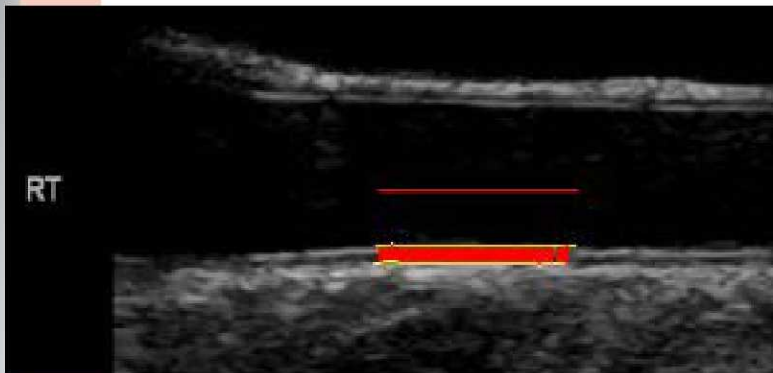
- New uses for ultrasound
- New protocols for ultrasound
- New techniques in remote and telemedicine uses of ultrasound



Transition to Clinical Practice



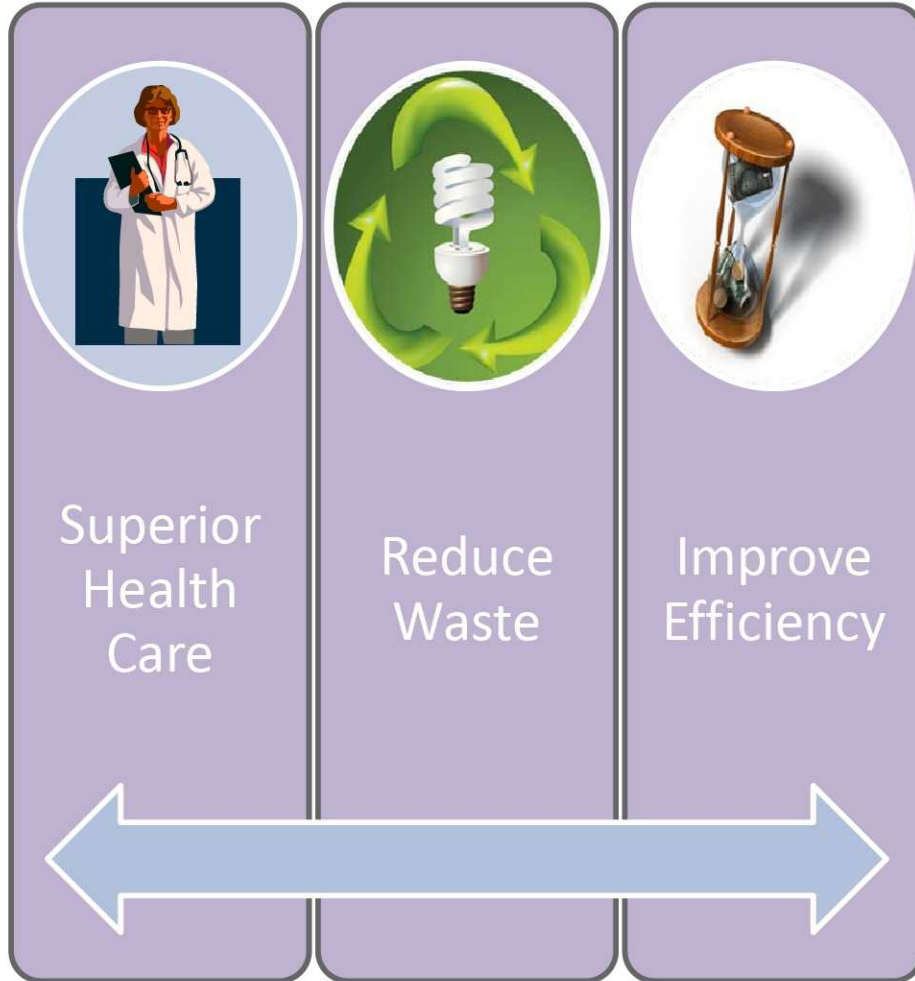
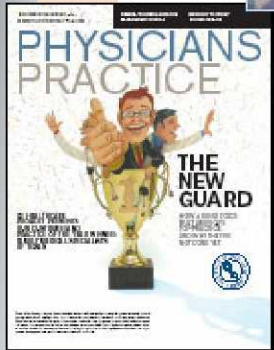
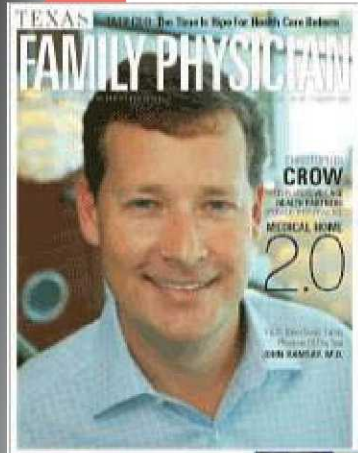
- JPL software used to study subpixel images of planets (can distinguish 256 shades of gray at the micro pixel level).
- Tech used from Carotid Intima-Medial Thickness ultrasound to evaluate plaque.
- Clinical Practice Guidelines from Cardiology consultants.



Arteriovision CIMT
Feb 2010 Polk



Transition to Mindset





Transition to Access



Global
Standardized
Medical
Records
Access
Using the
“Cloud”

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Your Health is Our Mission



Transition to Operations Thru Innovation

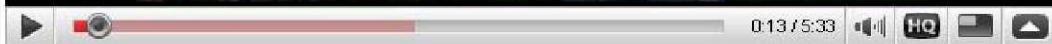
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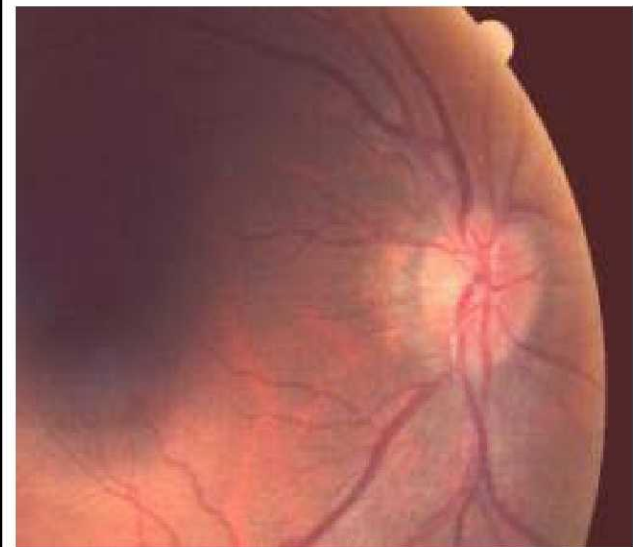
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Transition to Quality

MAYO
CLINIC



USC

6σ



Continental





Summary

Research

Evaluation and Validation

Operations

- Keys to Success
 - Ground research in operational need
 - Research product must have a clear use
- Transition requires rich communication between research and operational personnel
- It's about more than spaceflight hardware or treatments in orbit.
- It's about any process, change, or improvement that either enables our mission, gains knowledge, or translates back to Earth.
- We are about making spaceflight safe for the astronaut's lifetime,...not just during the flight.