Recent Results from NASA Bed Rest Studies

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- Located at University of Texas Medical Branch (UTMB) in Galveston, TX
- 10-bed hospital unit
- Access to hospital facilities
- Metabolic kitchen
- Standardized conditions
- Standard measures
NASA Bed Rest Studies

- **14-day Bed Rest Campaign**
  - Efficacy of Jobst Compression Garments to Prevent Orthostatic Intolerance Following 14 Days of Bed Rest.
    - M. Stenger, Wyle
    - Examine a schedule for progressive removal of the compression garments to facilitate re-adaptation to vertical after bed rest.
  - Surveillance of Ocular Parameters in long duration bed rest subjects
    - G. Vizzeri, University of Texas Medical Branch
    - Surveillance of vision during long duration head-down tilt bed rest.
  - Standard Measures
Compression Garment Design

- Three pieces, with zippers, to ease donning
- Custom fit, graded compression
  - 55 mmHg ankle
  - 35 mmHg knee
  - 18 mmHg thigh
  - 16 mmHg abdomen
Protocol

- **Bed rest protocol**
  - 2 weeks pre-bed rest
  - 2 weeks 6° head-down tilt bed rest
  - 1 week post bed rest

- **Subject Groups (n=16)**
  - **Group I (Control)** - Garments worn BR+0 morning only
  - **Group II (Treatment)** - Garments worn BR+0, BR+1 and BR+2
Methods (testing)

- Plasma volume (BR-5, +0, +1, +2, +3)
- Cardiac Function (BR-5, +0, +1, +3)
- Head-up tilt test (15 minutes) (BR-5, +0, +1, +3)
- Anthropometric Measures (BR-5, +0, +1, +2, +3)
- Circumference of Ankle, Calf, Thigh, Abdomen
- Comfort Logs (BR+0, +1, +2)
Results: Tilt Test

- **Survival analysis**
  - Typical response of subjects without garments after 30-days of bed rest (red line).
  - Garments were successful at preventing orthostatic intolerance during the tilt test on BR+0 (yellow line).
ACG: Plasma Volume

BR+0 < BR-5 (p = 0.019)
Heart Rate w/ and w/o ACG

HDT30

ACG

Heart Rate (bpm)

30 day bed rest

14 day bed rest
ACG: Heart Rate

† BR+3 compared to BR-5: Treatment > Control (p = 0.021)

* BR+0 < BR-5 (p = 0.047)
ACG: Stroke Volume

* BR+0 > BR-5 (p = 0.014)
Cardiac Output

No effect of Day or Treatment
Conclusions

- While garments were successful for preventing orthostatic intolerance, continued use beyond BR+0 may inhibit efficient re-adaptation.
- Use of garments is recommended on BR+0 and only as needed on subsequent days.
## Visual Surveillance

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<th>BR-10</th>
<th>BR-3</th>
<th>BR4</th>
<th>BR11</th>
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</table>
Visual Surveillance Results

- Kolmogorov-Smirnov test was not significant for any vision tests.
- Suggesting conservatively that pre- to post distributions are not different, even though in a couple of cases the Somer’s d statistic suggested increases or decreases pre/post.

- The figure summarizes the Somer’s d results and the 95% confidence interval (CI) for each outcome variable balanced around a zero-reference line. This plot provides a visual representation of the direction and magnitude of association for the effect of bed rest on each outcome measure.
70-day NASA Bed Rest Studies

- Physiological Factors Contributing to Post Flight Changes in Functional Performance
  - J. Bloomberg, NASA
  - Identification of the key underlying physiological factors that contribute to performance of functional tests that are representative of critical mission tasks

- Integrated Resistance and Aerobic Training Study (iRATS)
  - L. Ploutz-Snyder, USRA
  - Evaluation of the efficacy of a new integrated resistance and aerobic training (iRAT) program designed to minimize loss of muscle, bone and cardiovascular function
70-day NASA Bed Rest Studies

- **Testosterone supplementation as a countermeasure against musculoskeletal losses during space exploration**
  - R. Urban, University of Texas Medical Branch
  - Examination of testosterone supplementation in conjunction with exercise (iRATS) to protect against functional loss of muscle and bone.

- **Effects of retronasal smelling, variety and choice on appetite & satiety**
  - J. Hunter, Cornell University
  - Examination of fluid shift effects on taste, olfaction and trigeminal response; and compare odorant acceptability ratings for pure, food-related odorants to subjects’ appetite, or desire to eat a meal.

- **Surveillance of Ocular Parameters in long duration bed rest subjects**
  - G. Vizzeri, University of Texas Medical Branch
  - Surveillance of vision during long duration head-down tilt bed rest.

- The 70-day studies are integrated to run as a complement. Seventy days were needed due to the cycling of testosterone administration.
Questions?