Standardized Measures for Managing and Reducing Behavioral Health and Performance Risks

*Investigators Workshop*

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Thomas J. Williams, PhD  
Element Scientist  
Human Factors and Behavioral Performance
Agenda

• Trends toward Standard Measures?
• HRP’s Vision
• Standard Measures-Baseline
• Behavioral Core Measures
• BHP-Standard Measures: HERA
• Research vs Standard Measures
<table>
<thead>
<tr>
<th>Domain</th>
<th>Measure</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race or ethnic group†</td>
<td>1. What is your race?</td>
<td>At entry</td>
</tr>
<tr>
<td></td>
<td>2. Are you of Hispanic, Latino, or Spanish origin?</td>
<td></td>
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<tr>
<td>Education</td>
<td>1. What is the highest level of school you have completed?</td>
<td>At entry</td>
</tr>
<tr>
<td></td>
<td>2. What is the highest degree you earned?</td>
<td></td>
</tr>
<tr>
<td>Financial-resource strain</td>
<td>How hard is it for you to pay for the very basics like food, housing, medical care, and heat?</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td>Stress</td>
<td>Stress means a situation in which a person feels tense, restless, nervous, or anxious, or is unable to sleep at night because his or her mind is troubled all the time. Do you feel this kind of stress these days?</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td>Depression</td>
<td>Over the past 2 weeks, how often have you been bothered by</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td></td>
<td>1. Little interest or pleasure in doing things?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Feeling down, depressed, or hopeless?</td>
<td></td>
</tr>
<tr>
<td>Physical activity</td>
<td>1. On average, how many days per week do you engage in moderate to strenuous exercise (like walking fast, running, jogging, dancing, swimming, biking, or other activities that cause a light or heavy sweat)?</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td></td>
<td>2. On average, how many minutes do you engage in exercise at this level?</td>
<td></td>
</tr>
<tr>
<td>Tobacco use†</td>
<td>1. Have you smoked at least 100 cigarettes in your entire life?</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td></td>
<td>If yes:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Do you now smoke cigarettes every day, some days, or not at all?</td>
<td></td>
</tr>
<tr>
<td>Alcohol use†</td>
<td>1. How often do you have a drink containing alcohol?</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td></td>
<td>2. How many standard drinks containing alcohol do you have on a typical day?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. How often do you have six or more drinks on one occasion?</td>
<td></td>
</tr>
<tr>
<td>Social connection or isolation</td>
<td>1. In a typical week, how many times do you talk on the telephone with family, friends, or neighbors?</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td></td>
<td>2. How often do you get together with friends or relatives?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. How often do you attend church or religious services?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. How often do you attend meetings of the clubs or organizations you belong to?</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td>Intimate-partner violence</td>
<td>1. Within the last year, have you been humiliated or emotionally abused in other ways by your partner or ex-partner?</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td></td>
<td>2. Within the last year, have you been afraid of your partner or ex-partner?</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td></td>
<td>3. Within the last year, have you been raped or forced to have any kind of sexual activity by your partner or ex-partner?</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td></td>
<td>4. Within the last year, have you been kicked, hit, slapped, or otherwise physically hurt by your partner or ex-partner?</td>
<td>Screen and follow up</td>
</tr>
<tr>
<td>Residential address†</td>
<td>What is your current address?</td>
<td>Verify at every visit</td>
</tr>
<tr>
<td>Census-tract median income</td>
<td>Geocoded</td>
<td>Update on address change</td>
</tr>
</tbody>
</table>

* Wording is taken from existing measures; standard response categories are available. Psychometric testing of the full panel, including ordering and wording, has not yet been conducted.
† This domain is already widely included in clinical practice.

Benefits of Standard Measures

- Accurately characterizes risk factors and outcomes
- Provides researchers the opportunity to evaluate cross-discipline relationships among multiple systems involved in adapting to, living in, and returning from space
- Systematically assess changes over time within and across missions in spaceflight and spaceflight analogs
Why Behavioral Health and Performance Standard Measures?

- Facilitate integrated assessment & understanding
- Identify & characterize risk across settings & missions
- Expand capacity: more sensitive/specific identification of “space normal”
  - Better define countermeasures
  - Tailor (personalized)
  - Precision medicine
- Psychosocial “vital signs”
Future 1YM Program

- HRP is proposing a coordinated program of 1YM, taxi flights, and 6-month missions
  - Same measures at 3 discrete durations
  - Larger n, increases confidence in 1YM data
  - May observe early changes in adaptation not noticed previously

Slide credit to Letty Vega
Mission Unknowns

trend dynamics unknown

Slide credit to Letty Vega
Considerations for Selection of Standard Measures - HRP

- Assess every Human Health and Performance Risk in HRP
- Should be based on validated/established measures
- Primarily outcome measures tied to health and performance

- Establish a baseline for testing of future in-flight countermeasures
- Enable comparison of one-year and six-month missions
- Provide standard measurements for investigators to use in proposed projects
- Provide database (LSDA) for data-mining and integrative modeling

- A Standard Measure in a discipline area does not mean that future projects cannot propose new measures for specific investigations in that area
## Standard Measures-Baseline

### 60 Day
- **Mission**: Cognitive testing and VAS
  - Team functioning
  - Biochemical markers (blood only)
  - Sleep quality (actigraphy & PMC questions)
  - Cellular profile - Immune (ambient blood, saliva)
  - Swabs of skin and nasal mucosa, saliva, and fecal samples
  - Sit to stand test/tandem walk, recovery from fall, motion sickness eval
  - cIMT

### 180 Day
- **Mission**: Cognitive testing and VAS
  - Team functioning
  - Biochemical markers (blood only)
  - Sleep quality (Actigraphy & PMC questions)
  - Cellular profile - Immune (ambient blood, saliva)
  - Swabs of skin and nasal mucosa, saliva, and fecal samples
  - Sit to stand test/tandem walk, recovery from fall, motion sickness eval
  - cIMT

### 365 Day
- **Mission**: Cognitive testing and VAS
  - Team functioning
  - Biochemical markers (blood only)
  - Sleep quality (Actigraphy & PMC questions)
  - Cellular profile - Immune (ambient blood, saliva)
  - Swabs of skin and nasal mucosa, saliva, and fecal samples
  - Sit to stand test/tandem walk, recovery from fall, motion sickness eval
  - cIMT

### Med Bs
- **Mission**: Comprehensive ocular/visual testing (MedB 1.10)
- **Mission**: Nutritional assessment (MedB N3.06)
- **Mission**: DXA
- **Mission**: Physical Exam (MedB 1.1; full exam and two brief)
- **Mission**: Blood and urine data (MedB 2.1)
- **Mission**: Periodic Health Status exams (MedB 1.2) and PMCs (MedB 1.3)
- **Mission**: In-flight medication logs
- **Mission**: VO2 max (MedB 4.1)
- **Mission**: Event reporting - EMU injuries via PHSSs (1.2) and PMCs (1.3)
- **Mission**: Event reporting - DCS reports via PMCs (MedB 1.3)
- **Mission**: Functional fitness assessments
- **Mission**: Computerized Dynamic Posturography
- **Mission**: Crew Debriefs (Food, HAB, HARI, TRAIN, TASK, etc)
- **Mission**: ISS Environmental data: air, surface, H2O microbial monitoring
- **Mission**: MR0093, MR005L, MR004L, MedB 3.1 - Radiation monitoring
  - **Mission**: Air and water quality (real-time and archival samples)

### Risk Assessment
- **Risk**: BMED
  - TEAM
  - VIIP, Food Medical
  - *Sleep*
  - Immune
  - Microhost and Immune
  - Sensorimotor Alterations
  - VIIP, Degen, Immune

### Overall Characterization
- **Overall characterization of health of crewmember**: (as clinically indicated)
- **Overall characterization of environment and crew exposures during mission**: (every three months)
Behavioral Health and Performance Standard Measures & Habitability

• Psychological Factors relevant to success of mission
  – **Individual** (adaptation and performance)
    • Personality
    • Motivation
    • Visual/Perceptual Processing
  – **Group** (small groups in confined quarters)
    • Psychosocial factors
    • Reduce interpersonal conflict/conflict resolution
    • Decrease risk of psychological problems

– **Environmental**
  • Social organizational
    – Meaningfulness/division of labor
    – Intellectual challenge/Avoiding boredom
  • Design (harmonious group living)
    – Privacy
    – Habitability (sleep areas)
    – Social (interpersonal connectedness in flight, back to earth)
Behavioral Health and Performance Purpose & Risks

Purpose
Manage and mitigate the behavioral health and performance risks associated with space travel, exploration and return to terrestrial life

Risk of Adverse Cognitive & Behavioral Conditions and Psychiatric Disorders

Risk of Performance and Behavioral Health Decrement due to Inadequate Cooperation, Coordination, Communication and Psychosocial Adaptation within a Team

Risk of Performance Decrement and Adverse Health Outcomes Resulting from Sleep Loss, Circadian De-synchronization, and Work Overload
Behavioral Health and Performance Standard Measures

Why - To establish a common set of measures for use in spaceflight and analog research to: develop baselines, systematically characterize risk likelihood and consequences, and assess countermeasure effectiveness.
Behavioral Health and Performance Standard Measures

Behavioral Core Measures NRA
Implement validated measures to assess cognition, operational performance, well-being, team cohesion, sleep and circadian phase

- **Cognition** (Vigilant attention, psychomotor speed, lapses of attention, impulsivity, etc.)
- **Neurobehavioral signs of stress & fatigue** (mental & physical) using Visual Analog Scales (VAS)
- **Personality** (“Big Five Factors”)
- **Journals**
- **Team cohesion vs conflict**
- **Actigraphy** (activity/wake cycles)
- **ROBoT** (operational performance task)

HRP Standard Measures
- Covers all HRP risks
- Allows comparison of 6 & 12 month ISS missions

- Cognition
- Neurobehavioral assessments using VAS
- Team cohesion vs conflict
- Actigraphy
- ROBoT
- Additional measures as appropriate (e.g., personality factors related to spaceflight adaptability)
**BHP Standard Measures**

**HERA Pre-Mission**
- Cognition Familiarization 4X
  - Pre-battery questions
  - Mental exhaustion
  - Fatigue
  - Stress
  - Workload
  - Sleep Quality
- Performance
- ROBoT 3X
- Questionnaires (VAS)
  - Psychological Screening
  - BDI Depression Screen 6X
  - POMS_SF 3X
- Team Measures
- Big Five NEO-120
- Demographics

**BMed**
- Cognition Battery 19X
  - Pre-battery questions
  - Mental exhaustion
  - Fatigue
  - Stress
  - Workload
  - Sleep Quality
- Team Measures
  - Group Living (3X)
  - Sociometric Badges
  - Pre-sleep (daily)
  - Crew/MCC
  - Cohesion
  - Conflict
  - Performance
  - Team Weekly (6X)
  - Team Climate
  - Team Process
  - Social Support (4X)

**Team**
- Sleep & Fatigue
  - Actigraphy monitoring
  - Sleep/Wake activity
  - Actigraph (daily)
  - Cognition (PVT)

**HERA Post-Mission**
- Post-Mission Debrief
  - Cognition Battery 3X
    - Pre-battery questions
    - Mental exhaustion
    - Fatigue
    - Stress
    - Workload
    - Sleep Quality
  - Performance
    - ROBoT 19X
    - Cognition (PVT)
  - Questionnaires
    - Psychological Screening
    - BDI Depression Screen
    - SDS-17 (social desir)
    - POMS_SF 3X
  - Team Measures 1X
    - Big Five NEO-120
    - Demographics

**During HERA Mission**

**Modeled after Dinges et al, Behavioral Core Measures**
# HRP Standard Measures
(Not final)

## ISS Pre-Mission
- **Cognition Battery (monthly)**
  - Pre-battery questions
  - Mental exhaustion
  - Fatigue
  - Stress
  - Workload
  - Sleep Quality
- **Questionnaires (VAS)**
  - Pre-Sleep
  - Post-Sleep (daily)
  - Other
  - Subjective
  - Psychological Screening (every 3 wks)
- **Team Measures**
  - Group Living (3X)
  - Cohesion
  - Conflict
  - Performance
  - Team Climate
  - Team Process
  - Social Support
  - 3-5 items
- **Performance**
  - ROBoT 3X monthly
  - Cognition (monthly)
  - 3-5 items
- **Post-Mission Debrief**
  - Cognition Battery 3X
    - Pre-battery questions
    - Mental exhaustion
    - Fatigue
    - Stress
    - Workload
    - Sleep Quality
  - Questionnaires
    - Psychological Screening
    - BDI Depression Screen
    - POMS-SF 1X
  - Performance
    - ROBoT 3X

## BMed
- **Cognition Battery (monthly)**
  - Pre-battery questions
    - Mental exhaustion
    - Fatigue
    - Stress
    - Workload
    - Sleep Quality
- **Questionnaires (VAS)**
  - Pre-Sleep
  - Post-Sleep (daily)
  - Other
  - Subjective
  - Psychological Screening (every 3 wks)
- **Team Measures**
  - Group Living (3X)
  - Cohesion
  - Conflict
  - Performance
  - Team Climate
  - Team Process
  - Social Support
  - 3-5 items
- **Performance**
  - ROBoT 1X monthly
  - Cognition (monthly)
  - 3-5 items

## Team
- **Actigraphy monitoring**
  - Sleep/Wake activity
  - Actigraph (daily)

## Sleep & Fatigue
- **Post-Mission Debrief**
  - Cognition Battery 3X
    - Pre-battery questions
    - Mental exhaustion
    - Fatigue
    - Stress
    - Workload
    - Sleep Quality
  - Questionnaires
    - Psychological Screening
    - BDI Depression Screen
    - POMS-SF 1X
  - Performance
    - ROBoT 3X

## ISS Post-Mission

**During ISS/inflight Mission (minimum numbers)**

DRAFT  (these will be revised based on results of Dinges et al BCM research results, 0/a May 2017)
Challenges of Standard Measures

- Cultural change ("frames of thinking")
  - Social & behavioral determinants
- "Standard" exists…
  - Available
  - Useful (valid & reliable)
  - Feasible & acceptable (to measure & to know)
    - Not available from other sources (unobtrusive measures)
- Privacy vs operational mission
  - Not overly sensitive to ask
  - Operational relevance vs research "interests"
- Added demands: elusive "Gold standard"
- Sensitivity/specificity of data (continuum)
  - Lab result vs psychological "result"
  - Monitoring vs intervention
QUESTIONS?