

Information Paper

Subject: Behavioral Health and Performance Laboratory Standard Measures (BHP-SM)

The Spaceflight Standard Measures is a NASA Johnson Space Center Human Research Project (HRP) project that proposes to collect a set of core measurements, representative of many of the human spaceflight risks, from astronauts before, during and after long-duration International Space Station (ISS) missions. The term “standard measures” is defined as a set of core measurements, including physiological, biochemical, psychosocial, cognitive, and functional, that are reliable, valid, and accepted in terrestrial science, are associated with a specific and measurable outcome known to occur as a consequence of spaceflight, that will be collected in a standardized fashion from all (or most) crewmembers. While such measures might be used to define standards of health and performance or readiness for flight, the prime intent in their collection is to allow longitudinal analysis of multiple parameters in order to answer a variety of operational, occupational, and research-based questions. These questions are generally at a high level, and the approach for this project is to populate the standard measures database with the smallest set of data necessary to indicate further detailed research is required. Also included as standard measures are parameters that are not outcome-based in and of-themselves, but provide ancillary information that supports interpretation of the outcome measures, e.g., nutritional assessment, vehicle environmental parameters, crew debriefs, etc.

The project’s main aim is to ensure that an optimized minimal set of measures is consistently captured from all ISS crewmembers until the end of Station in order to characterize the human in space.

- This allows the HRP to identify, establish, and evaluate a common set of measures for use in spaceflight and analog research to: develop baselines, systematically characterize risk likelihood and consequences, and assess effectiveness of countermeasures that work for behavioral health and performance risk factors.

- By standardizing the battery of measures on all crewmembers, it will allow the HRP to evaluate countermeasures that work for one physiological system and ensure another system is not negatively affected.

- These measures, named “Standard Measures,” will serve as a data repository and be available to other studies under data sharing agreements.

Specific Aims for BHP-SM:

The BHP-SM represent one component of the HRP plan to provide a minimal backbone of ongoing assessments of crewmember health and performance across all remaining ISS increments, including future year-long missions and multi-week taxi missions, for all crewmembers who provide informed consent. It is not intended to displace on-going peer-reviewed investigations.

- Aim 1. Provide standard measurements for investigators to use in proposed projects. This allows NASA to streamline and make more efficient the use of multiple measurements collected on research participants during analog research and helps to ensure a reduced burden on these research participants by using a “standard” set of

measures for data sharing by multiple PIs.

-Aim 2. Enable comparison of multiple missions across analog campaigns.

The “standardized measures” increase the generalization of findings across research analogs, increasing the validity and reliability of measures used to assess the impact of spacelike analogs on behavioral health and performance.

-Aim 3. Provide database for data-mining and integrative modeling and increase research data transfer to NASA research data archives (e.g., LSAH, LSDA).

BHP-Standard Measures

Baseline BHP-SM Battery – Prior to their analog mission, participants will complete a one-time, brief battery of BHP Standard Measures that assess stable, trait-like individual differences that have been shown to be associated with health and performance outcomes. These measures will include brief (120 item) measure of personality based on the “Big Five Factors” of personality. Other pre- and post-mission questionnaires include assessment of team processes and functioning, sleep-wake activity, mood and emotions (e.g, brief screen of depressed mood) and a thirty-seven item Profile of Mood States (POMS mood survey)

Cognitive testing – The Cognition test battery is a software-based combination of 10 brief tests, evaluating different aspects of cognitive function, such as, visual object learning, memory, attention, abstraction, spatial orientation, emotion recognition, abstract reasoning, complex scanning and visual tracking, risk decision making, sensorimotor ability, and vigilant attention. These tests provide a validated, sensitive, and objective measure of major cognitive domains to characterize cognition over the duration of an analog or spaceflight mission.

The Robotic OnBoard Trainer (ROBoT). The ROBoT is NASA’s platform for training astronauts to perform docking and grappling maneuvers using the Canada Arm and is used in BHP-SM as an operational performance measure.

Visual Analog Scales (VAS) – Visual Analog Scales, or VAS, measure psychosocial constructs such as mood, fatigue, conflict, and stress.

Team Functioning – Team functioning is assessed across multiple factors (e.g., cohesion, conflict, team processes including decision-making and problem solving). A brief questionnaire is provided daily using a VAS, Likert-type scale items, and open-ended questions.

Sociometric Badge: Sociometric badges are worn daily by the crew during waking hours over the course of the mission. These badges use accelerometers and IR sensors to detect interactions between crew members based on relative proximity and time spent face-to-face.

Actigraphy - Includes data downloaded from an advanced technology actigraphy wrist-watch.

Sleep-related questions – Pre- and postflight a very brief daily sleep log is completed during the periods that actigraphy is collected. The pre- and postflight phases of actigraphy have an associated daily sleep log.

Anticipated Benefits of Standard Measures

-Accurately characterize risk factors and outcomes.

-Provide opportunity to evaluate inter-relationship among and across disciplines,

and inter-disciplinary understandings of multiple systems involved in spaceflight deconditioning and adaptation.

-Systematically assess changes over time within and across missions in spaceflight and spaceflight analogs.

Conclusion: Collection of “Standardized Measures” allows for greater consistency and fidelity of data collected, enhancing the data archiving capabilities of analog outcomes and increasing the probability that data will actually get archived. Although data management agreements require PIs to submit their data after completion of their research, the exact format and timeliness of that data submission varies greatly between PIs. The collection of “standardized measures” via internal directed studies, helps to ensure more timely, valid, and accessible data resources to help guide risk reduction.

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