

Longitudinal Health Surveillance (LHS)

OCHMO-TB-043
Rev A



Relevant Technical Requirements

NASA-STD-3001 Volume 1, Rev C
[V1 3018] Post-Mission Long-Term Monitoring

Executive Summary

Longitudinal Health Surveillance (LHS), known at NASA as Occupational Surveillance, includes the medical procedures and actions taken to ensure the in-mission and long-term health of the astronaut. It also provides a mechanism to document any observed spaceflight-associated changes. LHS includes a wide variety of health-related topics that are performed pre-, in-, and post-mission. Training, countermeasures, and post-mission reconditioning should all be employed to help the crewmember achieve, maintain, and recoup their maximal health status. In addition, pre-mission measures help to reduce the need for more extensive in-mission medical care, as well as mitigate the risks of spaceflight. By taking a prevention approach rather than a reactionary approach, total onboard resources and required mission capabilities can be lessened.

The table below displays the interaction between five key elements that are necessary to promote crew health and performance:

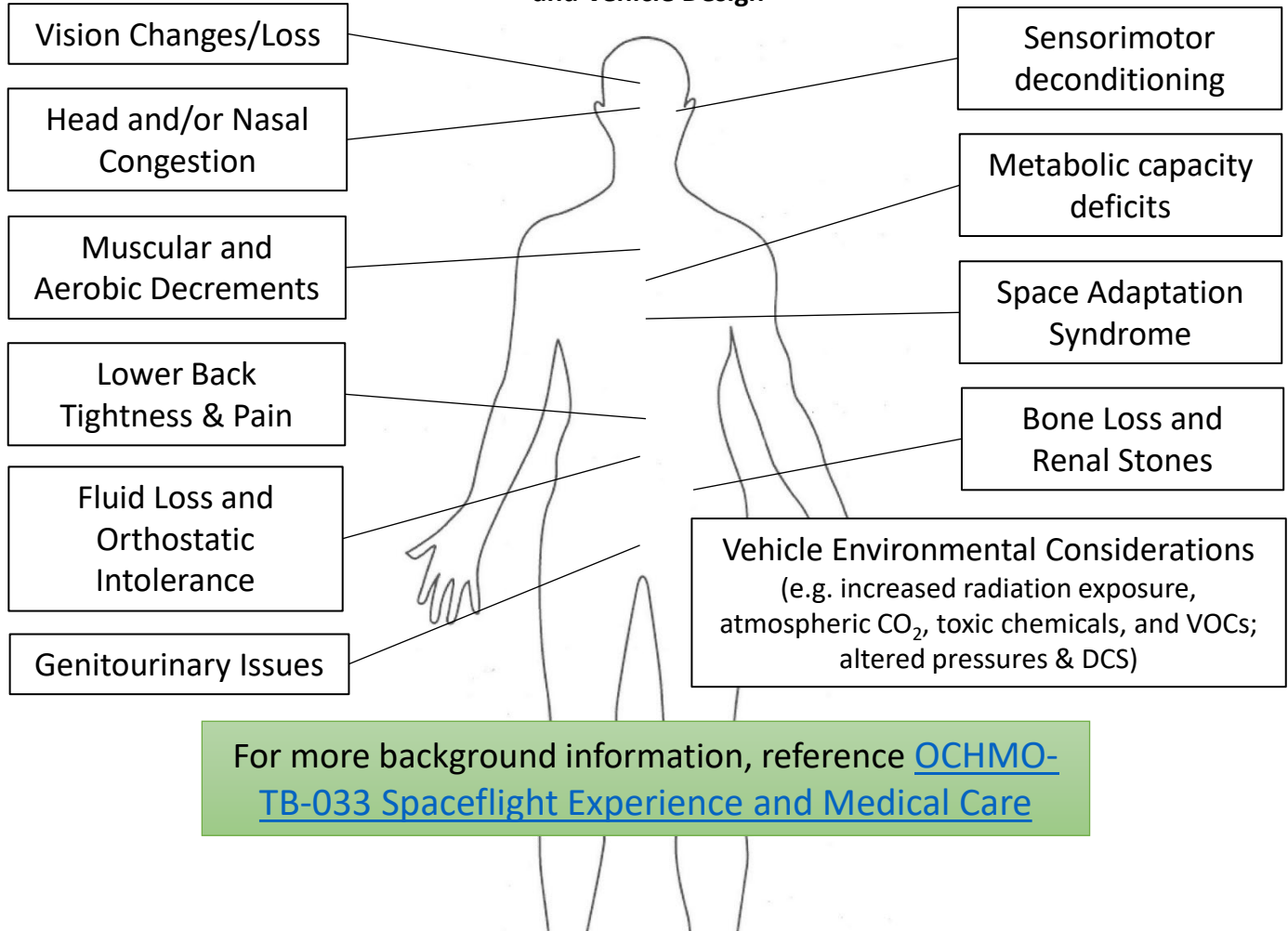
1. Crew Selection Standards [OCHMO-TB-034 Crew Selection and Recertification](#)
2. Health Stabilization Program (HSP) – [OCHMO-TB-006 Health Stabilization Program \(HSP\)](#)
3. In-mission Medical Treatment & Capabilities – [OCHMO-TB-033 Spaceflight Experience and Medical Care](#)
4. Immediate Post-landing Medical Care – i.e., medical care post-flight/post-mission
5. Longitudinal Health Surveillance – covered in this technical brief

Pre-mission		In-mission		Post-mission	
<i>Selection Standards</i>					
	<i>Health Stabilization Program</i>				
		<i>In-mission Medical Treatment & Capabilities</i>		<i>Immediate Post-landing Care</i>	
Longitudinal Health Surveillance					



Background

Prevalent Physiologic Changes Experienced due to Microgravity and Vehicle Design



For more background information, reference [OCHMO-TB-033 Spaceflight Experience and Medical Care](#)

TREAT Astronauts Act (2017)

- Described by NASA as the authorization for “occupationally related medical monitoring, diagnosis, and treatment for our former astronauts who have completed at least one spaceflight mission.”
- Covers all conditions that NASA considers “potentially associated” with spaceflight
- Enhanced the Lifetime Surveillance of Astronaut Health, an established NASA effort
- More information at: <https://www.nasa.gov/general/about-treat-astronauts-act/>



Reference Data

NASA’s Procedures for Longitudinal Health Surveillance

NASA employs pre-, in-, and/or post-mission procedures for the following topics depending on mission duration and architecture. Each topic, if implemented, differs in the phase of the mission they are used, measurement parameters (e.g., vitals, lab tests, etc.), and deliverables (e.g., reports, electronic medical record submissions, downlinks, etc.).

Physical exam (pre-, in-, & post-)	ECG (pre- & post-)	Neurological assessment (pre-, in-, and post-)*
Neurovestibular Platform Test (pre- & post-)*	Hearing assessment (pre-, in-, & post-)	Body mass measurement (in-)
Nutritional assessment (pre-, in-, & post-)	Dental exam, with orthopantomogram (pre-)	Eye examination (pre-, in-, & post-)*
Ultrasound imaging (pre-)*	Photodocumentation of the skin (as required; in-, post-)	Laboratory testing (pre-, in-, post-)*
<i>H. pylori</i> and Tuberculosis testing (pre-)	MRSA nasal screen and suppression (pre- & post-)	Radiation monitoring /Personal Dosimetry (in- & post-)
Toxicological assessment, with air & water quality monitoring (in-)	Microbial analysis (in-)	EVA medical monitoring and prebreathe protocols (pre- & in-)
Psychiatric/Psychological status check (pre-, in-, & post-)	Cognitive assessment (pre- & post-)	Observation of training by behavioral health & performance team (pre-)
Bone densitometry (pre- & post-)	Functional fitness assessment (pre- & post-)*	Exercise (aerobic & resistive; in-)
Isokinetic testing, or equivalent (pre- & post-)*	Aerobic functional capacity testing (pre-, in-, & post-)	

**Denotes topics that have additional information listed on the following page*

Reference Documents

NASA-STD-3001 Volumes 1 & 2 – <https://www.nasa.gov/directorates/esdmd/hhp/human-spaceflight-and-aviation-standards/>

NASA SD/Space Medicine Operations – MedBs and MRIDs

Summary of H.R.6076, 114th Congress – <https://www.congress.gov/bill/114th-congress/house-bill/6076>

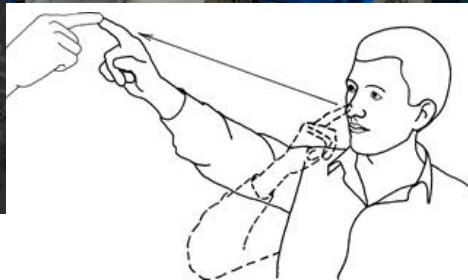
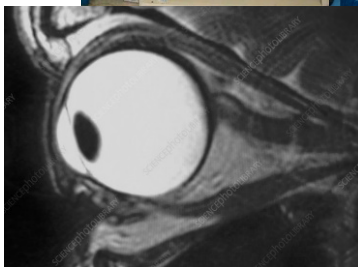
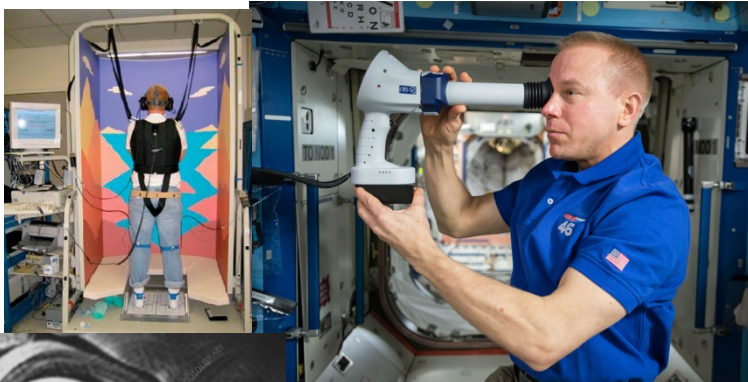
NASA’s “TREAT Astronauts Act FAQs” – <https://www.nasa.gov/hhp/treat-act>

Reference Data

NASA's Procedures for Longitudinal Health Surveillance

Additional information on select LHS topics

- Neurological & neurovestibular assessments
 - Dynamic Posturography – pre- and post-mission (L-90/30 and R+8 days, resp.)
 - Pre- & post-mission neurological assessment (performed in conjunction with physical exams) – neurological signs & symptoms (e.g. headache, vertigo), motor performance (gaze/ocular movements, finger-to-nose test, drift), and gait & station (rising from chair, standing/Romberg, leg lift – hop, tandem/heel-to-nose walk, and dynamic equilibrium)
- Eye examinations
 - Pre-mission – L-21/18 m and/or L-9/6 m
 - MRI; eye exams (incl. visual acuity – distance & near; refraction – manifest & cycloplegic; threshold visual fields; Amsler grid; contrast sensitivity; pupil reflexes; extraocular muscle balance; biomicroscopy; dilated fundoscopic examination; retinal photography; tonometry; optical coherence tomography (high res), including SVP videography; optical biometry); contact lens / spectacle fitting; 2-D imaging ultrasound
 - Less comprehensive eye exam on L-90/30 days
- In-mission – L+30 d, L+90 d, L+180 d, L+270 d, and/or R-30 d; or, as clinically indicated
 - Visual testing with and without contrast sensitivity (incl. acuity – near and far; and Amsler Grid); fundoscopy; 2-D imaging ultrasound; OCT; tonometry
- Post-mission – 1-3 days post-landing, unless otherwise noted
 - Eye exam immediately post-landing
 - Comprehensive eye exam (details listed above); MRI; 2-D imaging ultrasound





Reference Data

NASA's Procedures for Longitudinal Health Surveillance

Additional information on select LHS topics

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- Ultrasound imaging
 - Pre-mission – <L-365 d, or as clinically indicated
 - Abdominal and retroperitoneal ultrasound (males and females); pelvic ultrasound (females)
- Laboratory testing
 - Pre-mission – L-90/30 d
 - Blood collection – hematology, chemistry profile, ionized calcium, thyroid function, iron profile, and any special chemistries (e.g. C-reactive protein, serum lipids, mouse IgE allergen panel, etc.)
 - Variable urine collection – urinalysis and pregnancy test
 - Post-mission – R+0/1 d, R+3/7 d (as clinically indicated), and R+14/30 d
 - R+0/1 days: blood collection (hematology, i-Stat parameters); urinalysis
 - R+3/7: blood collection, as in pre-mission
 - R+14/30: blood collection (as in pre-mission) and urinalysis
- Functional fitness assessment – L-6/9 m, L-90/30 d, R+5/7, and R+30
 - Pre- & post-mission – sit and reach, bench press, push-ups, sit-ups, pull-ups, leg press, cone agility test, stand test, and hand grip
- Isokinetic testing – L-9/6 m, L-90/30 d, R+5 d, R+14 d, and R+30 d
 - Pre-mission – concentric knee extension & flexion, concentric ankle plantarflexion & dorsiflexion, eccentric ankle plantarflexion & dorsiflexion, and concentric trunk extension & flexion





Back-Up



Major Changes Between Revisions

Original → Rev A

- Updated information and standards to be consistent with NASA-STD-3001 Volume 1 Rev C and Volume 2 Rev D.



View the current versions of NASA-STD-3001 Volume 1 & Volume 2 on the [OCHMO Standards website](#)

Referenced Technical Requirements

NASA-STD-3001 Volume 1 Revision C

[V1 3018] Post-Mission Long-Term Monitoring Crewmembers returning from spaceflight shall be monitored longitudinally for health, behavioral health, and well-being parameters in a standardized manner.



Reference List

1. About TREAT Astronauts Act. 2023. Available at: <https://www.nasa.gov/general/about-treat-astronauts-act/>
1. Summary of H.R.6076, 114th Congress. Available at: <https://www.congress.gov/bill/114th-congress/house-bill/6076>