

Promoting Human Health through Manned Space Flight

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Overview

An evaluation of scientific literature related to the contributions of manned space flight to space safety and health was performed. Physiological effects discovered from NASA's first manned missions and contributions of the Russian space program to long duration space flight with special emphasis on in-flight and post-flight re-adaptation experiences were included.

Key Findings

Adaptation Response	Physiologic	Current Best Practice Intervention	Pre-flight adaptation Intervention
Space Motion Sickness (SMS)	Visuo-vestibular mismatch (Coriolis effect)	Pharmacologic (i.e. Promethazine)	Barany Chair Device for Orientation and Motion Environments (DOME)
Sleep Disturbance	Desynchronosis of circadian rhythm causing disruption of the hormonal signals of the pituitary gland	Pharmacologic (i.e. Restoril, Dalmane), sleep made a mission objective	Sleep shifting several days before flight
Fluid Shift	Fluid shifts to the head and neck, kidney 's diuresis of up to 3% total body weight	Lower body neg. pressure (LBNP) Devices (Chibis suit) , NaCl tablets & water loading prior to re-entry	None identified
Bone Mineral Density (BMD) loss	Trabecular bone loss predominantly in legs. Elevated serum Ca can potentially manifest as renal calculi	High impact stress exercises, Supplemental dietary Ca, Pharmacologic (i.e. Clodronate)	None identified
Muscle Atrophy	Slow-twitch muscles necrose and become like fast-twitch muscle which are much less affected	Penguin Suit, Pharmacologic, Exercise (i.e. cycle ergometer & treadmill)	None identified
Cardiac deconditioning	Space anemia, carotid baroreceptors less responsive, dysrhythmias	Aerobic training, Pharmacologic, (i.e. nitroglycerin) Penguin Suit, Chibis suit	None identified
Psychological Impact	Apathy, asthenia, isolation, disrupted interpersonal relations, withdrawal	Private conference with family, Medical conference with flight surgeons, personal effects, exercise, vodka	Simulations of cramped quarters

Impact

- Provides insight into the ineffectiveness of current exercise and non-exercise countermeasures utilized in long duration LEO (low earth orbit) missions
- Increased understanding of the physiologic space norm has furthered the treatment and preventative measures for akin terrestrial ailments.
- Exploration into the solar system will only increase the understanding of physiology and interdependence of the human body's multiorgan systems.

Explanation

- The American Astronautical Society is committed to our ability to mitigate the risks that lie within space exploration.
- This research prompts the need for further analysis of current countermeasures and reveals a need to investigate methods of facilitating re-adaptation.
- The emphasis of life science research must be on the facilitation of physiological and psychological achievement of the space norm with minimal stress to the flight crew.

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