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CREW FITNESS FOR LONG-DURATION SPACE TRAVEL

Abstract

Purpose: Maintaining balanced psychological and physiological attributes during space travel is essential for an efficient and productive work environment. The NASA Human Exploration Research Analog at Johnson Space Center uses conditions for simulating long-duration space travel. Through tasks and stressors, the HERA investigators hope to determine vital elements for favorable team composition and translation to space missions.

Methods: The NASA HERA Campaign 3, Mission 4 was a 30-day isolation study in an analog habitat (636 sq. ft.) at JSC-NASA that housed 4 crew from September to October of 2016. Participants were selected using comparable measures for qualifying NASA astronauts. Fourteen days were reserved for pre-mission training and seven days for debriefing post-mission. Biosensors tracked vital signs, and neurological sensors were assigned to crew for virtual spacewalks. Workdays mirrored the astronaut's schedule used on the ISS, (0700 - 2300). The crew was required to perform tasks at specific times each day regardless of any stressor. Each team participated in scheduled mission activities, including research, public relations, and daily exercise. Meals were provided using surplus food prepared for the ISS; snacks from groceries stores were included once the daily crew meals were consumed. Sleep deprivation was introduced to assess a crew's composition and effectiveness under stress. The physiological, psychological, and social behavior of HERA's crew was examined during weekly medical and psychological assessments, and by study protocol approved questionnaires. Campaign 3, composed of four mission teams, was the basis for research on behavioral performance, team performance, crew medical, and enabling technologies.

Results: Campaign 3 included twenty-two different research studies. Current results only exist from Weber et al. (2019) and gathered measures from seventeen non-isolated participants' and sixteen isolated, analog crew members. Fasting blood draws concluded that cortisol levels showed heightened stress for the HERA crew versus the non-isolated group [1]. The five-minute resting electroencephalography displayed parietal cortex activity decrease for the analog group [1]. Battery tests indicated an increase in cognitive performance for both groups [1].

Conclusions: Weber et al. results convey that brain activity, temperament, and cognition did not create a considerable impact, regardless of elevated stress in isolation [1]. However, overall results are still preliminary. There are additional, independent researchers who have yet to publish their findings, thus, progressing toward developing countermeasures, including the discovery of initial indications for health deterioration, and task execution. Citations: 1. Weber J, Javelle F, Klein T, Foitschik T, Crucian B, Schneider S, Abeln V. (2019, Jun). Neurophysiological, neuropsychological, and cognitive effects of 30 days of isolation. *Exp Brain Res.*, 237(6), 1563-1573. doi: 10.1007/s00221-019-05531-0. Epub 2019 Mar 29.