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| Fiscal Year: | FY 2023 | Task Last Updated: | FY 11/25/2022 |
| PI Name: | Alfano, Candice Ph.D. | | |
| Project Title: | Characterization of Psychological Risk, Overlap with Physical Health, and Associated Performance in Isolated, Confined, Extreme (ICE) Environments | | |
| Division Name: | Human Research | | |
| Program/Discipline: | | | |
| Program/Discipline--Element/Subdiscipline: | HUMAN RESEARCH--Behavior and performance | | |
| Joint Agency Name: | TechPort: | No | |
| Human Research Program Elements: | (1) HFBP : Human Factors & Behavioral Performance (IRP Rev H) | | |
| Human Research Program Risks: | (1) BMed : Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders | | |
| Space Biology Element: | None | | |
| Space Biology Cross-Element Discipline: | None | | |
| Space Biology Special Category: | None | | |
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| Zip Code: | 77204-5022 | Congressional District: | 18 |
| Comments: | | | |
| Project Type: | GROUND | Solicitation / Funding Source: | 2013-14 HERO NNJ13ZSA002N-BMED Behavioral Health & Performance |
| Start Date: | 11/13/2014 | End Date: | 09/30/2022 |
| No. of Post Docs: | 1 | No. of PhD Degrees: | 3 |
| No. of PhD Candidates: | 2 | No. of Master' Degrees: | 0 |
| No. of Master's Candidates: | 0 | No. of Bachelor's Degrees: | 0 |
| No. of Bachelor's Candidates: | 0 | Monitoring Center: | NASA JSC |
| Contact Monitor: | Whitmire, Alexandra | Contact Phone: | |
| Contact Email: | alexandra.m.whitmire@nasa.gov | | |
| Flight Program: | | | |
| Flight Assignment: | <p>NOTE: End date changed to 9/30/2022 per NSSC information (Ed., 8/24/21)</p> <p>NOTE: End date changed to 9/30/2021 per NSSC information (Ed., 4/22/2020)</p> <p>NOTE: End date changed to 3/31/2020 per NSSC information (Ed., 1/29/2020)</p> <p>NOTE: End date changed to 12/31/2019 per NSSC information (Ed., 7/17/19)</p> <p>NOTE: End date changed to 5/31/2019 per NSSC information (Ed., 2/12/19)</p> <p>NOTE: End date changed to 1/31/2019 per NSSC information (Ed., 12/28/18)</p> <p>NOTE: End date changed to 11/12/2018 per NSSC information (Ed., 12/13/17)</p> <p>NOTE: Element change to Human Factors & Behavioral Performance; previously Behavioral Health & Performance (Ed., 1/17/17)</p> | | |
| Key Personnel Changes/Previous PI: | July 2021 report: Dr. Matthew Gallagher was added as a Co-Investigator-statistician during the NCE starting in April 2020; Dr. Mitzi Laughlin is no longer CoI on the project. | | |

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| COI Name (Institution): | Connaboy, Christopher Ph.D. (University of Pittsburgh) Simpson, Richard Ph.D. (University of Houston) Gallagher, Matthew Ph.D. (University of Houston) |
| Grant/Contract No.: | NNX15AC13G |
| Performance Goal No.: | |
| Performance Goal Text: | |
| Task Description: | <p>Anecdotal and empirical findings collected in space and other extreme environments continue to highlight the potential for psychological symptoms and conditions to degrade crew performance, increase conflict, and jeopardize mission success. Indeed, ‘negative reactions’ during periods of isolation, confinement, demanding work schedules, stimulus reduction, separation from loved ones, sleep deprivation, and a host of other stressors are more appropriately viewed as normative rather than pathogenic. Selection methods and countermeasures serve to mitigate some degree of psychological risk, but long-duration space flight will substantially extend exposure to these and other stressors. Previous research documenting psychological symptoms experienced during space flight and in other isolated and confined environments (ICE) provides evidence of a wide range of psychological and behavioral reactions. Unfortunately however, these collective data ultimately serve to raise more questions than answers. Differences in collection methods, types of symptoms/reactions assessed, psychological constructs examined, and timing and duration of measurements limit conclusions that can be drawn from this research. As a result, understanding of the discrete symptoms and conditions most likely to occur during space flight and thus, ability to quantify the magnitude, probability, or consequences of such risk remains inadequate. The current project proposes to address these notable gaps in knowledge via three specific Aims. First, we will conduct extensive scientific literature reviews and interviews with subject matter experts in order to synthesize existing knowledge of the psychological and behavioral symptoms experienced in space and other extreme environments (Aim 1). Our review will directly inform the development of a comprehensive checklist of symptoms to be monitored among 6 separate cohorts (i.e., 2 Antarctic and 4 Human Exploration Research Analog (HERA) cohorts)) as part of a longitudinal investigation (Aim 2). Symptoms will be examined based on their point/period prevalence, severity, and duration. The checklist will also be administered (repeatedly) in conjunction with a physical symptoms checklist in order to examine concurrent and sequential overlap between psychological and physical health symptoms as means of clarifying potential etiologies. Finally, our study will extend previous research by exploring relationships among psychological health, sleep loss/dysregulation, biomarkers of stress, and performance-based outcomes (Aim 3). A comprehensive battery of cognitive and performance measures (including a perception-action coupling task) will be administered repeatedly as part of our longitudinal study. These outcomes will inform a final list of psychological/ behavioral symptoms to be examined during an extended International Space Station (ISS) mission.</p> |
| Rationale for HRP Directed Research: | |
| Research Impact/Earth Benefits: | <p>Anecdotal and empirical findings collected in space and other extreme environments continue to highlight the potential for psychological symptoms and conditions to degrade crew performance, increase conflict, and jeopardize mission success. Indeed, ‘negative reactions’ during periods of isolation, confinement, demanding work schedules, stimulus reduction, separation from loved ones, sleep deprivation, and a host of other stressors are more appropriately viewed as normative rather than pathogenic. Selection methods and countermeasures serve to mitigate some degree of psychological risk, but long-duration space flight will substantially extend exposure to these and other stressors. Previous research documenting psychological symptoms experienced during space flight and in other isolated and confined environments (ICE) provides evidence of a wide range of psychological and behavioral reactions. Unfortunately however, these collective data ultimately serve to raise more questions than answers. Differences in collection methods, types of symptoms/reactions assessed, psychological constructs examined, and timing and duration of measurements limit conclusions that can be drawn from this research. As a result, understanding of the discrete symptoms and conditions most likely to occur during space flight and thus, ability to quantify the magnitude, probability, or consequences of such risk remains inadequate. Thus, there is a need to: (1) identify the psychological/behavioral symptoms that pose the greatest threat to performance; (2) provide accurate and acceptable risk thresholds; (3) inform screening and selection processes; (4) guide further development of suitable working practices (standard operating procedures); and (5) develop interventions and counter measures to mitigate these risks.</p> <p>This project specifically addresses several knowledge gaps related to Risks of Adverse Behavioral Conditions and Psychiatric Disorders [Ed. note: August 2021--Gaps have changed since this grant was awarded in FY2015; see Human Research Roadmap https://www.nasa.gov/human-research-roadmap] including: Gap 1 (Need to identify and quantify the key threats to and promoters of mission relevant behavioral health and performance during exploration class missions) and Gap 3 (Need to identify and validate measures to monitor behavioral health and performance and determine acceptable thresholds for these measures during exploration missions). Our primary goal is to identify the psychological and behavioral health symptoms with the greatest likelihood of occurrence during extended human space flight/habitation to space and to estimate associated levels of threat imposed to mission-based performance. As a final deliverable, a checklist of symptoms will be developed for implementation during an ISS mission (>6 months) in order to determine its feasibility, reliability, and facilitation of evidence-based decision making with regard to crew health, safety, and mission success.</p> <p>As a first step, we will conduct extensive scientific literature reviews and interviews with subject matter experts in order to synthesize existing knowledge of the psychological and behavioral symptoms experienced in space and other extreme environments (Aim 1). Our review will directly inform the development of a comprehensive checklist of symptoms to be monitored in two longitudinal studies including one HERA campaign and cohorts at the McMurdo and South Pole Antarctic stations (Aim 2). The checklist will also be administered (repeatedly) in conjunction with a list of physical complaints in order to examine concurrent and sequential overlap between psychological and physical health symptoms. Finally, our study will extend previous research by exploring relationships among psychological health, sleep dysregulation, biomarkers of stress, and performance-based cognitive outcomes (Aim 3). A comprehensive battery of cognitive and performance measures will be administered in conjunction with our other measures as part of our longitudinal study. Outcomes will inform a final mental health checklist for use during long duration space flight. As a supplemental Aim, we will examine the reliability of our mental health checklist in two Antarctic cohorts at the Palmer station.</p> |

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| Task Progress: | <p>All project Aims have been met. We developed a 23-item self-report Mental Health Checklist (MHCL) to assess psychological health in isolated confined extreme (ICE) settings. The MHCL includes three reliable subscales—positive adaptation, poor self-regulation, and anxious apprehension—each assessing unique aspects of psychological health. In a 9-month longitudinal study, we assessed 110 personnel stationed at either McMurdo (coastal station) or South Pole (inland station). At the South Pole station, a total of 22 participants were enrolled and 88 participants were enrolled at the McMurdo station. Because crew at McMurdo are not required to be on station for the entire winter season, there was variability in the number of monthly sessions completed at this station. Antarctic participants were predominantly White (94.5%, n = 104) males (80%, n = 88) between the ages of 22 and 70 years old (M = 37.63, SD = 11.95). Because the greatest number of McMurdo participants completed 6 months of assessments, this time point was used to compare monthly outcomes across the two stations. For all participants, MHCL positive adaptation scores decreased significantly and MHCL poor self-regulation scores increased significantly from baseline to the end of study. Overall change in MHCL anxious apprehension scores across mission were non-significant, though month-to-month variability was observed. Higher poor self-regulation scores were observed at McMurdo compared to the South Pole during the early months of the mission. Anxious apprehension scores were significantly higher at the McMurdo station than at South Pole during all months.</p> <p>Prevalence and severity of physical symptoms increased significantly from baseline to the end of study in the full Antarctic sample but there were no significant differences in physical symptoms between the two stations. Changes in biomarkers of stress (cortisol, DHEA, or the cortisol:DHEA ratios) were not observed from baseline to the end of the mission. However, cortisol and cortisol:DHEA ratios were significantly higher among McMurdo compared to South Pole participants. Cognitive performance was also examined monthly using the Psychomotor Vigilance Test (PVT), the Spaceflight Cognitive Assessment Tool for Windows (WinSCAT), and the Perception-Action Coupling Task (PACT). Performance on the WinSCAT improved during early mission months and was sustained through the end of the study. PACT performance decreased across mission, but no changes were observed in PVT scores.</p> <p>Several study participants underwent emergency evacuation from the McMurdo station during the study. We examined monthly reports, biomarkers, and cognitive performance among 4 evacuees compared to the remaining McMurdo sample (n = 84) to identify potential indicators of distress prior to evacuation. Emergency evacuation occurred for medical reasons (n = 2) or for psychiatric reasons (n = 2). Elevated MHCL anxious apprehension scores were most common among all evacuees. Elevated physical symptoms were also apparent in one psychiatric and one medical evacuee in the months prior to evacuation. We did not find any biomarker of stress or objective sleep regularity to differ among evacuees compared to the full sample.</p> <p>At the Palmer station, the MHCL measure was administered to 26 participants during two winter-over seasons. MHCL data were collected for 4 consecutive months. The Palmer station is similar to the McMurdo station in climate and its coastal location, but similar to the South Pole in terms of size/number of residents. Similar to Antarctic participants at the McMurdo and South Pole stations, positive adaptation scores declined across mission whereas changes in poor self-regulation were more modest. The greatest increases in anxious apprehension scores were observed in later mission months.</p> <p>Collective findings indicate the MHCL is a reliable and useful measure for assessing psychological risk in ICE settings. Each of the MHCL scales contributes unique information in this regard, particularly when combined with assessment of physical complaints.</p> |
| Bibliography Type: | Description: (Last Updated: 12/23/2022) |
| Articles in Peer-reviewed Journals | <p>Kim J, Cifre A, Bower J, Connaboy C, Simpson R, Alfano C. "Markers of distress among behavioral and physical health evacuees prior to emergency departure from Antarctica." <i>Acta Astronaut.</i> 2022 Oct 31. https://doi.org/10.1016/j.actaastro.2022.10.052 , Oct-2021</p> |