

Fiscal Year:	FY 2016	Task Last Updated:	FY 09/01/2015
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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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Comments:			
Project Type:	GROUND	Solicitation / Funding Source:	2013-14 HERO NNJ13ZSA002N-BMED Behavioral Health & Performance
Start Date:	11/13/2014	End Date:	11/12/2017
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No. of PhD Candidates:	3	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
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Flight Program:			
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Key Personnel Changes/Previous PI:	None		
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Task Description:

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 8 separate cohorts (i.e., 4 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 the Space Medicine Exploration Medical Condition List (SMEMCL) 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.

Rationale for HRP Directed Research:

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.

Research Impact/Earth Benefits:

This project specifically addresses several knowledge gaps related to Risks of Adverse Behavioral Conditions and Psychiatric Disorders including: Gaps 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.

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 among 8 separate cohorts (i.e., 4 Antarctic and 4 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 the Space Medicine Exploration Medical Condition List (SMEMCL) 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 ISS mission.

Project objectives for Year 1 include: 1) obtaining Institutional Review Board (IRB) approval for the protocol from the University of Houston (UH) and NASA; 2) hiring a project coordinator; 3) conducting a comprehensive literature review of the effects of ICE environments on psychological/behavioral health; 4) completing a review paper summarizing findings from the literature review; 5) conducting SME interviews; 6) obtaining all self-report measures and licenses; and 7) modifying perception-action coupling software for the HERA environment. Each of these goals has been met or is underway as described below.

IRB approval from UH was obtained in February 2015 and from NASA in May 2015. A project coordinator was hired for the project and will begin work at UH in October 2015. The literature review is well underway and a final review paper is expected to be submitted to NASA in December 2015. The PI has completed 9 out of 10 total SME interviews,

Task Progress:

including interviews with: a NASA psychologist, a NASA psychiatrist, two NASA flight surgeons, a NASA astronaut, a psychologist involved in selection for work ICE environments, a crewmember of the 520-day Mars500 study, a scientist from NASA's Explorations Medical Capability Unit, and a medical doctor with Antarctic winterover experience. The perception action coupling software and equipment are currently being modified to suit the HERA environment. We have also submitted the Science Requirements Document for our protocol to NASA Flight Analogue Projects (FAP) for the 2016 HERA campaign and have begun to assemble the final version of our Neurobehavioral Checklist for use in all HERA cohorts.

Bibliography Type:

Description: (Last Updated: 12/23/2022)