Fiscal Year:	FY 2021	**Task Last Updated:**	FY 04/07/2021
PI Name:	Mehta, Satish Ph.D.		
Project Title:	Varicella Zoster Virus Shedding After Antiviral Drug (Valacyclovir) Treatment in Antarctic Expeditioners		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Biomedical countermeasures		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **Immune**:Risk of In Mission Impacts, Adverse Health Events or Long-Term Health Impacts due to Altered Immune Response		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	satish.k.mehta@nasa.gov	**Fax:**	FY
PI Organization Type:	NASA CENTER	**Phone:**	281-483-5459
Organization Name:	Enterprise Advisory Services, Inc.		
PI Address 1:	NASA Johnson Space Center		
PI Address 2:	Microbiology, 1100 Hercules Ave, 305		
PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77058-2720	**Congressional District:**	36
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2017 HERO 80JSC017N0001-Crew Health and Performance (FLAGSHIP1, OMNIBUS). Appendix A-Flagship1, Appendix B-Omnibus
Start Date:	07/10/2018	**End Date:**	10/01/2022
No. of Post Docs:	0	**No. of PhD Degrees:**	1
No. of PhD Candidates:	0	**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:	Brocato, Becky	**Contact Phone:**	
Contact Email:	becky.brocato@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: End date changed to 10/1/2022 per L. Singh/HRP JSC (Ed., 4/8/21)		
Key Personnel Changes/Previous PI:	April 2021 report: none		
COI Name (Institution):	Crucian, Brian Ph.D. (NASA Johnson Space Center) Locke, James M.D. (NASA Johnson Space Center) Pierson, Duane Ph.D. (NASA Johnson Space Center)		
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Task Description:	Previous spaceflight studies indicate that reactivation of varicella zoster virus (VZV), particularly during longer duration spaceflights, can potentially lead to clinical disease including zoster, chronic neuropathic pain, vision loss, stroke, and cognitive impairment. Furthermore, continued viral shedding after spaceflight may cause clinical disease in crew contacts including uninfected or immunocompromised individuals, as well as newborn infants. Thus, it is essential to develop spaceflight countermeasures to prevent VZV reactivation and ensure the health of the crew, as well as the health of their contacts upon return. One such countermeasure is prophylactic administration of an antiviral drug (valacyclovir) against VZV. In order to determine the effectiveness of this countermeasure using a large population, we propose to study VZV shedding in Antarctic expeditioners who have similar patterns of VZV DNA shedding in saliva as astronauts. Countermeasure efficacy of the antiviral drug will be determined by measuring VZV reactivation and shedding in saliva as well as measuring the physiological stress biomarkers (cortisol, DHEA, and salivary amylase) and immune markers (inflammatory cytokines) before, during, and after the winter-over period. The proposed research team has extensive experience in ground-based studies including studies conducted in Antarctica, Aquarius undersea habitat, and artificial gravity, as well as the coordination and conduct of complex multi-laboratory studies. In addition, the research team has proven expertise and experience in immunology, virology, and medical expertise working with infectious diseases and spaceflight subjects. This proposal addresses the need for developing and validating countermeasures as identified in the new NASA Research Announcement (NRA) 80JSC017N0001-OMNIBUS NASA HERO Omnibus Opportunity.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Our studies have demonstrated that reactivation of VZV, particularly during longer duration spaceflight, can potentially lead to clinical disease including zoster, chronic neuropathic pain, vision loss and cognitive impairment. Furthermore, continued viral shedding post-spaceflight may cause clinical disease in crew contacts including uninfected or immunocompromised individuals, as well as newborn infants. Thus, it is essential to develop spaceflight countermeasures to prevent VZV reactivation and ensure the health of the crew, as well as the health of their contacts upon return. One such countermeasure is prophylactic administration of an antiviral drug (valacyclovir) against VZV. In order to determine the effectiveness of this countermeasure with a relatively large population, we propose to study VZV shedding in Antarctic expeditioners who have had similar patterns of VZV DNA shedding in saliva as astronauts. These findings will indicate if valacyclovir treatment will reduce or stop viral reactivation and its shedding in saliva. This will enhance the selection and vetting of potential countermeasures to address clinical risks associated with reduced immune function. This will improve crew health care on International Space Station (ISS) missions, and will further enable exploration-class missions.
Task Progress:	Study Overview: The study was conducted at both McMurdo and South Pole Stations during the 2020 winter season. 40 winter-over participants from McMurdo and from South Pole were recruited by the University of Texas Medical Branch (UTMB) point of contact (POC) to take part in the study. This study group was split into a treatment group and a control group. Subjects took the provided drug or placebo daily and collected saliva samples over a period of five consecutive days each month. Background and Significance: In a recent collaborative study with Dr. Alexander Chouker (European Space Agency-ESA physician researcher), 19 subjects at Concordia Station in Antarctica were examined during overwintering for their latent viral reactivation and shedding patterns in their saliva samples collected each month for before, during, and after winter-over period. VZV DNA was found by real time polymerase assay in 10 out of 19 subjects (52%) with most of the shedding occurring during the study than before or afterwards. This is about the same rate of VZV shedding as we have found in astronauts during short and long duration spaceflights (50-65%). This data provide the motivation for this proposal, i.e., that wintering over in Antarctica is an excellent analog to spaceflight for studying the efficacy of a countermeasure against viral shedding. More specifically, we can study the effect of antiviral agents (e.g., valacyclovir) during an Antarctica winterover and apply lessons learned to upcoming spaceflight missions. This might allow us to prevent viral shedding in astronauts and thus reduce the risk of contaminating the internal environment of the spacecraft with infectious viruses, as well as decreasing their risk of associated VZV diseases including zoster, chronic neuropathic pain, vision loss, stroke and cognitive impairment. Hypothesis: Prophylactic administration of valacyclovir (1 gram daily) to Antarctic expeditioners will significantly reduce salivary shedding of VZV compared to placebo controls. Measures of stress and immune dysregulation should remain unaltered. To test this hypothesis, we will treat 20 expeditioners with daily valacyclovir and another 20 with placebo and measure VZV DNA (as well as other herpesviruses) before, during, and after the expedition. Study Population * General description of the study population: Antarctica expeditioners * Target number of non-astronaut participants: Total 40: 20 experimental, 20 Placebo Saliva samples * About 900 human saliva samples (2 ml each) were collected in total throughout the winter season at McMurdo and 500 samples were collected from South Pole. * Samples were maintained at -80°C during shipping and received in the Immunology and Virology Lab of Johnson Space Center. Future plan: A detailed inventory of the samples collected from both McMurdo and South Pole will be done and a plan will be drawn to process these samples as described in the original proposal.
Bibliography Type:	Description: (Last Updated: 04/15/2025)