

Fiscal Year:	FY 2013	Task Last Updated:	FY 06/03/2013
PI Name:	Amin, Shreyasee M.D.		
Project Title:	Epidemiologic Analyses of Risk Factors for Bone Loss and Recovery Related to Long Duration Space Flight		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline-- Element/Subdiscipline:			
Joint Agency Name:	TechPort:	No	
Human Research Program Elements:	(1) HHC: Human Health Countermeasures		
Human Research Program Risks:	(1) Bone Fracture: Risk of Bone Fracture due to Spaceflight-induced Changes to Bone (2) Osteo: Risk Of Early Onset Osteoporosis Due To Spaceflight		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	amin.shrevasee@mayo.edu	Fax:	FY
PI Organization Type:	UNIVERSITY	Phone:	507-284-4277
Organization Name:	Mayo Clinic College of Medicine		
PI Address 1:	200 First Street SW		
PI Address 2:			
PI Web Page:			
City:	Rochester	State:	MN
Zip Code:	55905	Congressional District:	1
Comments:			
Project Type:	GROUND	Solicitation / Funding Source:	2007 Crew Health NNJ07ZSA002N
Start Date:	08/01/2008	End Date:	11/30/2016
No. of Post Docs:	0	No. of PhD Degrees:	0
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:	Ploeger, Stephanie	Contact Phone:	
Contact Email:	stephanne.l.ploeger22@nasa.gov		
Flight Program:			
Flight Assignment:	<p>NOTE: End date showing as 11/30/2016 per NSSC information (Ed., 5/3/17)</p> <p>NOTE: Extended to 7/31/2016 (previously 7/31/2015) per NSSC information (Ed., 4/19/16)</p> <p>NOTE: Extended to 7/31/2015 per J. Sibonga/JSC and NSSC information (Ed., 7/16/14)</p> <p>NOTE: Risk/Gap changes per IRP Rev E (Ed., 3/14/14)</p> <p>NOTE: End date is 7/31/2014, per NSSC information (Ed., 8/9/13)</p> <p>NOTE: End date changed to 7/31/2013 per NSSC information (Ed., 7/16/2012)</p> <p>NOTE: End date changed to 7/31/2012 per C. Guidry/JSC (2/7/2011)</p> <p>NOTE: Period of performance changed to 8/1/2008-7/31/2011 (from 5/20/08-5/19/11) per C. Guidry/JSC (3/2010)</p>		
Key Personnel Changes/Previous PI:	Dr. Sundeep Khosla was removed from the study in the fall of 2010.		
COI Name (Institution):	Sibonga, Jean (NASA-Johnson Space Center)		
Grant/Contract No.:	NNX08AQ20G		

Performance Goal No.:	
Performance Goal Text:	
Task Description:	<p>Bone loss is estimated to occur at a rate of 1% per month in space (microgravity), particularly in weight-bearing bones in the legs and spine. This rate of loss is equivalent to what we might lose in a year with advancing age on Earth. It remains unknown what this loss signifies for future fracture risk in crewmembers. While unloading of the skeleton in the weightless environment of space is considered the key factor contributing to bone loss, there are likely other factors that also play a role. Current prevention strategies have not been effective at preventing this bone loss. Improved understanding on the risk for fracture following long-duration space flight, as well as the factors contributing to bone loss in microgravity, and its recovery, are needed in order to develop better prevention strategies for the benefit of crew health, both during and after long-duration space exploration, and mission success.</p> <p>The proposed research will take advantage of an established population-based cohort, which includes men and women of an age range similar to crewmembers in the U.S. space program, who have had bone density measured over time. We will make comparisons between bone densities of crewmembers and the population-based data and use fracture prediction models derived from the cohort to make estimations on fracture risk among crewmembers. We will also explore the data already gathered to date during the U.S. human space program in order to summarize the current state of evidence available on additional risk factors related to bone loss and recovery in microgravity. The ultimate goal of this research proposal is to provide evidence-based information which may assist in guiding the direction of further research required to better understand the risk of bone loss and fracture among crewmembers and the strategies that could be developed to prevent it from occurring.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>This work will help establish the occupational risk of short and long-duration microgravity exposure on longterm bone health consequences among U.S. crewmembers. It will also serve to provide a comprehensive summary of the current evidence available on risk factors related to bone loss and recovery among U.S. crewmembers following long-duration space flight.</p>
Task Progress:	<p>Overview of Year 5</p> <p>As investigators external to NASA, there have been several different data access issues which posed a challenge to progress on work over the years. Over the period of the grant and no-cost extensions, we worked with our collaborators at NASA to overcome most issues, including the need to re-consent Mir crew for use of their data, which was completed at the end of 2011. Data assembly at NASA-JSC required for the study was completed by early 2012. Data cleaning and analyses are now underway related to Study Aims.</p> <p>Progress Related to AIM 1: To investigate the risk of microgravity exposure on long-term changes in bone health and fracture risk. .</p> <p>We have 100% participation rate of all U.S. crewmembers who have flown on at least one long-duration space mission on Mir or ISS as of December 2010 and had a post-flight bone density measured. We have 85% participation rate among U.S. crewmembers who have flown on short-duration space missions.</p> <p>A manuscript is in preparation on the age- and gender-expected prediction models for bone mineral density (BMD) loss which were derived from the Mayo population-based cohort of 348 men (age range at baseline: 22-90 years) and 351 women (range: 21-93 years) and then applied to the NASA cohort of long-duration U.S. crewmembers. Our findings indicate that 6-18 months after returning from a long-duration flight, BMD at most sites was still lower than predicted in men, but not in women. In analyses of men who had follow-up to 3 years after return from their long-duration flight, BMD at most sites was now closer to predicted except for the hip where it was still significantly lower.</p> <p>In analyses involving U.S. crew who have only served on short-duration missions in space, our results suggest that there do not appear to be any long-term negative effects of short duration space flight on bone density in women or, at most sites, in men.</p> <p>Progress Related to AIM 2: To provide a summary of the current evidence available on potential risk factors for bone loss, recovery, and fracture following long-duration space exploration.</p> <p>Data assembly at NASA-JSC on risk factors known to be related to bone loss and fracture risk was completed in early 2012. We plan to use these data to help better understand the variability in BMD loss and recovery, post-flight. Risk factor data include, but are not limited to, medication use, bone turnover markers, and surrogates of exercise status in-flight, such as changes in strength measures, and lean muscle mass. Data assembly is now complete and data cleaning is ongoing. We note that limited data on risk factors are available beyond the initial return post long-duration flights. Analyses are currently underway.</p>
Bibliography Type:	Description: (Last Updated: 07/01/2019)
Articles in Peer-reviewed Journals	<p>Orwoll ES, Adler RA, Amin S, Binkley N, Lewiecki EM, Petak SM, Shapses SA, Sinaki M, Watts NB, Sibonga JD. "Skeletal health in long-duration astronauts: Nature, assessment and management recommendations from the NASA bone summit." Journal of Bone and Mineral Research. 2013 Jun;28(6):1243-55. http://dx.doi.org/10.1002/jbmr.1948 ; PubMed PMID: 23553962 , Jun-2013</p>