Supercomputing Challenge
Interim Report

December 10, 2016

Team Members, Etc.

Team 3
6th Grade
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Background

When astronauts go into space, over time, their hearts get weaker, change shape, blood pressure gets lower and these problems stay even after the astronauts get back to Earth.

Executive Summary

Not applicable yet.

Statement of Problem

The problem is that deep space and long term missions into space - to the Moon, Mars and other places - will continue in the future. We need to do all we can to learn how to help keep humans healthy to continue to live long, useful lives and continue in their careers, here on Earth or in space.

Description of Methods

We have done some research. We have a lot more research to do.

We want to use NetLogo 5.3.1 to make agent models to see if we can help astronauts stay healthy.

Validating the Model

We want to run the model multiple ‘ticks’ to validate our model. Right now, we have no idea how many ticks make a valid model. We need to learn about validating, so we have more to look up and research.

Results

We want to learn what we can have astronauts do and how we can help them to stay physically and mentally strong. We want to do this for people here on Earth, for astronauts during their missions and for where ever they end up setting up bases, scientific camps and living modules, on other planets, etc.

Overview

Subcategory A

Subcategory B

Subcategory C

Subcategory Additional (D, E, etc.)

Coding

We are coding using NetLogo. We have watched tutorials to learn how to program turtles. We have read scientific papers to know more about this subject.

Acknowledgements

Ms. Gabrel, Mr. Henegar and Mr. Johnson

Screenshots

Code

References

See attached.

Keywords

Arrhythmias, cardiac
Atrial fibrillation
Atrial function

Data Information

Data Availability	Archiving in progress. Data is not yet available for this experiment.

Measurements

Body size
Conduit volume
Estimated autonomic balance
Gravitational gradient
Heart rate variability
++ -- View more
Left atrial active emptying fraction
Left atrial active emptying volume
Left atrial appendage emptying velocity
Left atrial passive emptying fraction
Left atrial passive emptying volume
Left atrial size
Left atrial total emptying volume
Left atrial volume
Left ventricular stroke volume
Maximal atrial volume at mitral valve opening
Mitral A wave velocity
P wave amplitude
P wave duration
P wave root mean square voltage
Total premature atrial contractions
Volume at mitral valve closure
Volume at onset of atrial systole

Mission/Study Information

Mission
Ground

Human Research Program (HRP) Human Research Roadmap (HRR) Information

Crew health and performance is critical to successful human exploration beyond low Earth orbit. The Human Research Program (HRP) investigates and mitigates the highest risks to human health and performance, providing essential countermeasures and technologies for human space exploration. Risks include physiological and performance effects from hazards such as radiation, altered gravity, and hostile environments, as well as unique challenges in medical support, human factors, and behavioral health support. The HRP utilizes an Integrated Research Plan (IRP) to identify the approach and research activities planned to address these risks, which are assigned to specific Elements within the program. The Human Research Roadmap is the web-based tool for communicating the IRP content.

The Human Research Roadmap is located at: https://humanresearchroadmap.nasa.gov/

+ Click here for information of how this experiment is contributing to the HRP's path for risk reduction.

This investigation will focus on the risk of atrial fibrillation. Extensive cardiac structural and arrhythmia analysis has already been performed by the ICV investigators. Only minor modifications to the ICV analysis plan will allow high resolution assessment of afib risk. The objective of this study, then, is to analyze previously acquired data to assess atrial morphology, electrophysiology, and risk for afib in subjects who completed ICV.

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APPROACH:
Previously acquired images (cardiac MRI, advanced echo/Doppler of the heart) will be analyzed to study atrial structure and function. Re-analysis of previously acquired Holter data will be used to study atrial electrical function.

RESULTS:
Results are not yet available for this investigation.

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Human Research Program (HRP) Human Research Roadmap (HRR) Information

Integrated Cardiovascular (ICV) 2.0: Assessing the Risk for Atrial Fibrillation in Astronauts during Long Duration Spaceflight (NNX15AP25G)

Principal Investigator	+ Levine, Benjamin D.
Research Area	Biomedical countermeasures
Species Studied	*Homo sapiens* (Human)
Study Type	+ NASA Ground-Based Investigations

Description

OBJECTIVES:
The Integrated Cardiovascular (ICV) Experiment (Cardiac Atrophy and Diastolic Dysfunction During and After Long-Duratio Spaceflight: Functional Consequences for Orthostatic Intolerance, Exercise Capacity, and Risk of Cardiac Arrhythmias (9 E377)) was perhaps the most ambitious and comprehensive cardiovascular study performed during the International Spac Station (ISS) era. The ICV experiment answered many questions relating to cardiovascular adaptation to long-duration spac flight, but questions remain. For example, as the astronaut population matures, numerous cases of atrial fibrillation (afib) hav been observed, primarily in active astronauts on the ground. Moreover, it appears possible that extensive exercise performe on the ISS, which prevents cardiac atrophy and cardiovascular (CV) deconditioning, may actually increase the risk of atri fibrillation. As a result, afib has become an important concern for flight medicine.

This investigation will focus on the risk of atrial fibrillation. Extensive cardiac structural and arrhythmia analysis has alread been performed by the ICV investigators. Only minor modifications to the ICV analysis plan will allow high resolutio assessment of afib risk. The objective of this study, then, is to analyze previously acquired data to assess atrial morpholog electrophysiology, and risk for afib in subjects who completed ICV.

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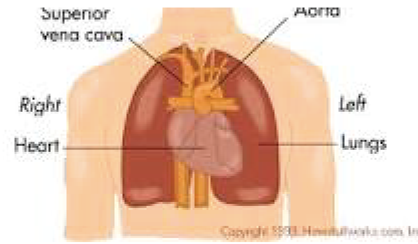
Mission/Study Information

Mission

It is 5 inches (**12 cm**) long, **3.5 inches** (**8-9 cm**) wide and **2.5 inches** (**6 cm**) from front to back, and is roughly the size of your fist. The average weight of a female human heart is 9 ounces and a male's heart is 10.5 ounces.



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Amazing Heart Facts

Sure, you know how to steal hearts, win hearts, and break hearts. But how much do you really know about your heart and how it works? Read on to your heart's content!

- Put your hand on your heart. Did you place your hand on the left side of your chest? Many people do, but the heart is actually located almost in the center of the chest, between the lungs. It's tipped slightly so that a part of it sticks out and taps against the left side of the chest, which is what makes it seem as though it is located there.
- Hold out your hand and make a fist. If you're a kid, your heart is about the same size as your fist, and if you're an adult, it's about the same size as two fists.
- Your heart beats about 100,000 times in one day and about 35 million times in a year. During an average lifetime, the human heart will beat more than 2.5 billion times.
- Give a tennis ball a good, hard squeeze. You're using about the same amount of force your heart uses to pump blood out to the body. Even at rest, the muscles of the heart work hard—twice as hard as the leg muscles of a person sprinting.
- Feel your pulse by placing two fingers at pulse points on your neck or wrists. The pulse you feel is blood stopping and starting as it moves through your arteries. As a kid, your resting pulse might range