



MELODI-2015 Abstract submission

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An Overview of NASA's Risk of Cardiovascular Disease from Radiation Exposure

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The association between high doses of radiation exposure and cardiovascular damage is well established. Patients that have undergone radiotherapy for primary cancers of the head and neck and mediastinal regions have shown increased risk of heart and vascular damage and long-term development of radiation-induced heart disease [1]. In addition, recent meta-analyses of epidemiological data from atomic bomb survivors and nuclear industry workers has also shown that acute and chronic radiation exposures is strongly correlated with an increased risk of circulatory disease at doses above 0.5 Sv [2]. However, these analyses are confounded for lower doses by lifestyle factors, such as drinking, smoking, and obesity.

The types of radiation found in the space environment are significantly more damaging than those found on Earth and include galactic cosmic radiation (GCR), solar particle events (SPEs), and trapped protons and electrons. In addition to the low-LET data, only a few studies have examined the effects of heavy ion radiation on atherosclerosis, and at lower, space-relevant doses, the association between exposure and cardiovascular pathology is more varied and unclear. Understanding the qualitative differences in biological responses produced by GCR compared to Earth-based radiation is a major focus of space radiation research and is imperative for accurate risk assessment for long duration space missions. Other knowledge gaps for the risk of radiation-induced cardiovascular disease include the existence of a dose threshold, low dose rate effects, and potential synergies with other spaceflight stressors. The Space Radiation Program Element within NASA's Human Research Program (HRP) is managing the research and risk mitigation strategies for these knowledge gaps. In this presentation, we will review the evidence and present an overview of the HRP Risk of Cardiovascular Disease and Other Degenerative Tissue Effects from Radiation Exposure.

[1] Darby S.C. et al (2013) NEJM 368, 987-98.

[2] Little M.P. et al (2012) Environ Health Perspect 120, 1503-11.