

## **Determination of the Risk of Radiation-Associated Circulatory and Cancer Disease Mortality in a NASA Early Astronaut Cohort**

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### **ABSTRACT**

Of the many possible health challenges posed during extended exploratory missions to space, the effects of space radiation on cardiovascular disease and cancer are of particular concern. There are unique challenges to estimating those radiation risks; care and appropriate and rigorous methodology should be applied when considering small cohorts such as the NASA astronaut population. The objective of this work was to determine if there was sufficient evidence for excess risk of cardiovascular disease and cancer in early NASA astronaut cohorts. NASA astronauts in selection groups 1-7 were chosen; this relatively homogeneous cohort consists of 73 white males, who unlike today's astronauts, maintained similar smoking and drinking habits to the general US population, and have published radiation doses. The participants flew in space on missions Mercury through Shuttle and received space radiation doses between 0-74.1 mGy. Cause of death information was obtained from the Lifetime Surveillance of Astronaut Health (LSAH) program at NASA Johnson Space Center. Mortality was compared with the US male population. Trends of mortality with dose were assessed using a logistic model, fitted by maximum likelihood. Only 32 (43.84%) of the 73 early astronauts have died. Standard mortality ratios (SMRs) for cancer (n=7, SMR=43.4, 95% CI 17.8, 84.9), all circulatory disease (n=7, SMR=33.2, 95% CI 13.7, 65.0), and ischemic heart disease (IHD) (n=5, SMR=40.1, 95% CI 13.2, 89.4) were significantly lower than for the US white male population. For cerebrovascular disease, the upper confidence interval for SMR included 100, indicating it was not significantly different from the US population (n=2, SMR = 77.0, 95% CI 9.4, 268.2). The power of the study is low and remains below 10% even when risks 10 times those reported in the literature are assumed [1]. Due to small sample size, there is currently insufficient statistical power to evaluate space radiation exposure effects on mortality in NASA astronauts. In addition to a comprehensive longitudinal study of NASA astronauts, a research strategy of low dose epidemiology data integration with cell and animal studies should be utilized for space radiation risk assessment in the astronauts.

### **REFERENCES**

[1] Little M.P. (2016) *Mutat Res* 770(Pt B), 299-318.