

RADIATION EXPOSURE AND MORTALITY FROM CARDIOVASCULAR DISEASE AND CANCER IN EARLY NASA ASTRONAUTS: SPACE FOR EXPLORATION

S. R. Elgart¹, M. P. Little², L. J. Chappell³, C. M. Milder⁴, M. R. Shavers³, J. L. Huff⁵, and Z. S. Patel³

¹University of Houston, Houston, TX; ²Radiation Epidemiology Branch, National Cancer Institute, Bethesda, MD; ³KBRwyle, Houston, TX; ⁴NASA Johnson Space Center, Houston, TX; ⁵MEI Technologies, Houston, TX.

INTRODUCTION

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 establish whether there is evidence for excess cardiovascular disease or cancer mortality in an early NASA astronaut cohort and determine if a correlation exists between space radiation exposure and mortality.

METHODS

NASA astronauts in selection groups #1-7 (1959-1969) were chosen for an observational cohort study and followed to either death or 2016, whichever occurred first. Cause of death information was obtained from the Lifetime Surveillance of Astronaut Health program at NASA Johnson Space Center. The astronauts participated in the Mercury through Shuttle programs; some selected astronauts never flew a space mission. 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. Total space radiation doses ranged from 0–74.1 mGy; mean medical dose was 25.1 mGy. Cardiovascular disease and cancer standardized mortality rates were calculated from comparisons with the U.S. white male population. A logistic regression model was used to assess the association of space radiation and disease mortality, adjusting for recorded medical radiation exposure.

RESULTS

This cohort comprises 49 living and 34 deceased white males contributing a total of 3,120.8 person-years. Mortality rates were significantly below the U.S. white male population rates for both cardiovascular disease (n=7, SMR=33; 95% CI, 14-65) and cancer (n=7, SMR=43; 95% CI, 18-85). For all endpoints, trends with space radiation dose were negative, although these results were not statistically significant. Statistical power of the logistic regression analysis was low at <6% and remains below 12% even if expected risk level or observed deaths are 10 times higher than currently reported [1].

CONCLUSIONS

No excess radiation-associated risk of cancer or cardiovascular disease mortality was observed, although all findings must be tempered by the statistical limitations of the small cohort. In addition to a comprehensive longitudinal study of NASA astronauts, a research strategy combining low dose epidemiology data integration with cell and animal studies should be used to support space radiation risk assessment in the astronauts.

REFERENCES

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