

Cancer Risk in Astronauts: A Constellation of Uncommon Consequences

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ABSTRACT

Excess cancers resulting from external radiation exposures have been noted since the early 1950s, when a rise in leukemia rates was first reported in young atomic bomb survivors [1]. Further studies in atomic bomb survivors, cancer patients treated with radiotherapy, and nuclear power plant workers have confirmed that radiation exposure increases the risk of not only leukemia, but also a wide array of solid cancers [2,3]. NASA has long been aware of this risk and limits astronauts' risk of exposure-induced death (REID) from cancer by specifying permissible mission durations (PMD) for astronauts on an individual basis. While cancer is present among astronauts, current data does not suggest any excess of known radiation-induced cancers relative to a comparable population of U.S. adults; however, very uncommon cancers have been diagnosed in astronauts including nasopharyngeal cancer, lymphoma of the brain, and acral myxoinflammatory fibroblastic sarcoma.

In order to study cancer risk in astronauts, a number of obstacles must be overcome. Firstly, several factors make the astronaut cohort considerably different from the cohorts that have previously been studied for effects resulting from radiation exposure. The high rate of accidents and the much healthier lifestyle of astronauts compared to the U.S. population make finding a suitable comparison population a problematic task. Space radiation differs substantially from terrestrial radiation exposures studied in the past; therefore, analyses of galactic cosmic radiation (GCR) in animal models must be conducted and correctly applied to the human experience. Secondly, a large enough population of exposed astronauts must exist in order to obtain the data necessary to see any potential statistically significant differences between the astronauts and the control population. Thirdly, confounders and effect modifiers, such as smoking, diet, and other space stressors, must be correctly identified and controlled for in those analyses.

In order to begin work assessing the astronaut population, the earliest groups of astronauts (selection groups 1-7) provide a unique model. These astronauts were relatively homogenous, white males whose lifestyle characteristics were similar to an average U.S. citizen of the same birth cohort. This work reviews radiation exposure levels, age, and causes of mortality among these early NASA astronauts and discusses the benefits and limitations of assessing such a cohort for radiation-induced cancer risk.

REFERENCES

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