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The Health Risks of Space Travel

Written by Jenna Flannigan on January 6, 2017

Since the year 2000, humanity has maintained a continuous presence in space aboard the International Space Station (ISS).

People from 18 different countries have spent time at the ISS. The record for longest continuous stay is held by U.S. astronaut Mark Kelly, who spent nearly one year there.

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But despite such achievements, space travel still involves a myriad of health risks for people.

From DNA damage caused by radiation exposure to the bone loss, muscle loss, and blood pressure changes that occur when living in microgravity, to name a few.

And the longer a person is in space, the greater the toll on their health.

It's a major challenge for the National Aeronautics and Space Administration

NASA conducts extensive research on how to make space travel safer.

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As part of this effort, NASA requested that the National Academies of Sciences, Engineering and Medicine provide an independent review of more than 30 evidence reports on the human health risks of long-duration and exploration spaceflights.

Today, a committee of experts at the National Academies released a new letter report — the fourth in a series of five — with their findings.

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Radiation risks

The latest review examines eight NASA evidence reports, with half of the topics focused on the health risks of radiation exposure in space.

“The radiation problem is the toughest one to solve and the most concerning,” Valerie Neal, Ph.D., a historian at the National Air and Space Museum, told Healthline.

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Neal spent 10 years working at NASA, but she was not involved in the current research.

On Earth, Neal explained, we are shielded by the planet's magnetic field and the protective gases in the atmosphere.

However, there's no effective way to shield astronauts from some types of radiation present in space, especially on a long journey such as a trip to Mars.

In particular, there is no technology to protect against galactic cosmic rays, a type of ionizing radiation likely produced by supernovae, or exploding stars.

That type of radiation can pass right through the hull of a spacecraft and the skin of people on board.

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Astronauts also face radiation risks from solar particle events, which are difficult to predict.

In its current review, the National Academies' committee looked at NASA's evidence reports on radiation exposure and increased risk of cardiovascular disease, cancer, central nervous system disorders, and acute radiation syndrome.

For the conditions covered in each report, the committee noted that NASA has well-documented evidence of the risks, although some studies rely heavily on animal models.

One area of growing interest is the link between radiation and cardiovascular disease.

The committee found that there's now enough evidence, "to support the conclusion that the risk of degenerative diseases from long-term exposure to space radiation may be of much greater concern than previously believed."

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Another major area of concern is cancer.

Radiation exposure can cause genetic damage that may increase an astronaut's risk of developing cancer years after their mission.

Currently, NASA sets the radiation limit for astronauts at a 3 percent cancer fatality probability.

For a mission on the ISS, where proximity to Earth provides some protection from radiation, women can stay about 18 months and men can stay about 24 months before exceeding the limit.

But on a mission to Mars, astronauts would be way over the limit, according to Francis Cucinotta, Ph.D., a professor of health physics at University of Nevada, Las Vegas, who authored the research on exposure limits.

Cucinotta worked for NASA for more than a decade, and developed a database that tracks astronauts' exposure to radiation and cancer risk estimates.

He told Healthline it would be a question of ethics whether to raise the risk limit to allow astronauts to travel to Mars.

"It requires a good discussion of whether you would accept that risk. And then how high of a risk would you accept?" Cucinotta said.

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Risks on top of risks

But the hazards of space aren't the only risks astronauts face on a long voyage.

They also have to put up with each other, while maintaining their own sanity in a small, cramped space.

The National Academies also examined NASA's evidence reports on mental health issues related to space travel and "behavioral health decrements" when team members aren't working well together.

Another report focused on the health risks associated with sleep loss, circadian rhythm issues, and work overload.

Lastly, the committee reviewed evidence on risks related to "vestibular/sensorimotor alterations," which include issues like space motion sickness.

different types of risks.

For example, lack of sleep and being overworked could have a big impact on how well a team of astronauts works together.

Teamwork issues are especially important to consider on long-duration missions, according to Neal.

“On a one- to two-week mission you are so busy, you don’t have time for interpersonal issues to form,” Neal told Healthline. But on longer missions, more psychological factors come into play.

She noted that being able to call family and friends back home and talk in real time has made a world of difference for astronauts’ mental health and well-being.

But those immediate connections wouldn’t be possible on a long mission to Mars — which could be a real source of stress for astronauts.

At the end of a mission, Neal explained, “No matter how productive they feel they’ve been, they all say they are eager to rejoin family and friends.”

Read more: Get the facts on motion sickness »

Health risks of space tourism

While NASA’s evidence reports focus on the risks of long-duration space travel for astronauts, there’s growing public enthusiasm about short-term space tourism for civilians.

But even a brief sojourn in space comes with health risks.

Neal noted that most of the risks of a long-duration spaceflight, like radiation exposure, wouldn’t be an issue for the brief commercial trips proposed by space tourism companies like Virgin Galactic.

On these trips, people are in outer space for only a few minutes.

However, space tourists could still experience the immediate side effects of being in a microgravity environment, such as space motion sickness.

“If the ratio among astronauts proves to be true of the general population, about half the people would experience some space motion sickness,” said Neal. “For some people it’s like queasiness and for some it’s nonstop vomiting.”

Neal said another pressing issue would be the safety of the commercial spacecraft itself.

The OECD Observer notes that the U.S. space program faced two crashes out of 113 departures, for a failure rate of 1.8 percent.

But for many, the risks are well worth the chance to see Earth at a distance.

So far, the only space tourists have been wealthy people who made trips to the ISS lasting between eight and 15 days.

For Neal, who has devoted much of her career to supporting space travel, the opportunity to do an orbital tour of Earth would be a dream come true.

If the price of a visit ever dropped low enough, she said she would do it — despite the risks.

“I would be just so thrilled at the view that I probably wouldn’t even think about it,” she said. “Everybody who has had that view says it is life altering, and it gives you such a different view of life and the cosmos.”

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