

RADIATION EXPOSURE

Radiation dose is only one factor when deciding whether to have an imaging study.

Total average annual radiation exposure
in the U.S. general population
(background + medical/man-made):

6.2 mSv

BACKGROUND (NATURALLY OCCURRING) RADIATION

Average naturally occurring
radiation in one year:

3.1 mSv



Radon gas
(in homes)

2.28 mSv



Cosmic radiation
(Living in Denver)

0.80 mSv



Cosmic radiation
(Living at sea level)

0.30 mSv



Terrestrial radiation
(from the ground)

0.21 mSv

MEDICAL & OTHER MAN-MADE RADIATION

Average medical &
man-made radiation
in one year:

3.1 mSv

SOURCE	APPROXIMATE ADULT DOSE (mSv)*	IMPORTANT POTENTIAL BENEFITS
Radiation worker annual exposure limit	50	Regulatory limit set for radiation safety purposes
Whole-body PET/CT	20 – 25	Cancer staging and recurrence evaluation
Head CT	2	Rapid evaluation of head injury, stroke, brain tumor, or other urgent issues
Mammogram	0.42	Breast cancer screening and diagnosis
Cone Beam CT (dental)	0.18	Detailed 3D imaging of teeth, jaw and surrounding structures for dental treatment
Chest X-ray	0.10	Rapid evaluation of lung infection, heart or lung conditions
Panoramic Dental X-ray	0.025	General evaluation of teeth and jaws
Dental X-ray (bitewing)	0.005	Evaluation of cavities and dental health
Flight from New York to Los Angeles	0.02 – 0.05	Quick and convenient method of travel (increased radiation exposure due to high-altitude flight)
Airport scanner**	0 – 0.0001	Rapid security screening



* These radiation dose estimates are for adults. Doses used in children can be significantly lower.
Pediatric doses vary with patient age, weight, and equipment.



** Millimeter wave technology scanners do **NOT** use ionizing radiation and have largely replaced backscatter X-ray
airport scanners, which deliver small levels of ionizing radiation.



**THESE DO NOT USE
IONIZING RADIATION**



Red light therapy

0 mSv



Whole-body MRI

0 mSv



Ultrasound

0 mSv



Cell phones
and electronics

0 mSv



Electric cars

0 mSv



For people with Li-Fraumeni syndrome, medically necessary imaging should always be discussed with your healthcare team,
balancing the benefits of diagnosis and treatment against potential radiation exposure. Discuss these risks and benefits and
ask about low-dose or radiation-free alternatives for your particular scenario with your care team. **See back of sheet for more information.**

mSv

mSv stands for millisievert, a unit used around the world to measure radiation dose.
Another unit you might see used in the United States is rem. 1 rem = 10 mSv.

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LI-FRAUMENI SYNDROME
LFSA
ASSOCIATION

A stronger tomorrow for families with Li-Fraumeni syndrome.



Radiation and Li-Fraumeni Syndrome

Ionizing Radiation

Everyone is exposed to ionizing radiation, an invisible form of high-energy radiation, in everyday life. There are two main sources of radiation: naturally-occurring and man-made (usually medical). Naturally-occurring radiation can come from the ground and even outer-space! Examples of man-made radiation include x-rays, CT scans, and PET scans. On average, a person is exposed to equal amounts of naturally-occurring and man-made radiation each year.

Ionizing radiation can damage our DNA, but thanks to our bodies' DNA-repair systems, typical exposure does not carry significant health risk. At high doses, the risk of unrepaired DNA damage increases, which can lead to cancer. This is more of a concern in someone with Li-Fraumeni syndrome (LFS), because changes in the *TP53* gene affect how cells respond to DNA damage.

MRI and ultrasound, commonly used imaging methods in people with LFS, do not use ionizing radiation.

This figure **on the other side of this sheet** shows relative doses of ionizing radiation from common tests and exposures. **It is important to keep in mind that often the benefits of radiation exposure (for example, a medically necessary scan or cancer treatment) are thought to outweigh the risk of developing a future cancer from the exposure.** There is currently no maximum annual limit for medically-indicated radiation for people with or without LFS.

Radiation therapy (RT) for cancer treatment directs very high doses of ionizing radiation at a tumor to kill the tumor cells, with some nearby healthy tissue also exposed. In people with LFS, the potential risk of developing another cancer after RT should be weighed against the benefits of treating the existing cancer. These risks are specific to each person and situation.

Other (Non-Ionizing) Radiation

Ultraviolet (UV) radiation can only travel skin-deep and is different from ionizing radiation, which can travel through our bodies. However, UV radiation can also cause damage to DNA and can increase the risk of skin cancers.

Cell phones do not emit ionizing radiation. They use radiowaves, similar to those used by your car radio. Radiowaves (or radiofrequency radiation) cannot damage DNA. So far, cell phone use has not been linked to increased risk of cancer.

Electric cars do not emit ionizing radiation. They produce electromagnetic fields, also known as electromagnetic radiation, similar to many household appliances.

To reduce radiation exposure:

- Confirm a scan is medically necessary without a reasonable radiation-free (e.g., MRI ultrasound) or radiation-reduced (e.g., low dose CT) alternative.
- Make sure the care team understands you have LFS and are sensitive to radiation.
- For routine dental x-rays, ask about the minimum imaging needed for good dental care. Note that shielding for x-rays is no longer needed due to the very low dose of x-rays, so this may be discontinued at your dentist's office.
- When considering RT, discuss the potential risk of a future cancer with RT versus the risk of progression or recurrence without RT
- Limit UV radiation exposure by practicing sun safety: wear sunscreen and protective clothing and hats, limit time in the sun at peak hours, and avoid tanning beds.
- Consider testing your home for radon and reducing radon levels if high.

Resources to learn more:

Radiation Protection of Patients — International Atomic Energy Agency

<https://www.iaea.org/resources/rpop/patients-and-public>

Radiation Safety in Pediatric Imaging — Image Gently

<https://www.imagegentlyparents.org/>

Additional Radiation Considerations in Pediatric Cancer Predisposition Surveillance — 2023 AACR Childhood Cancer Predisposition Workshop Report

<https://pubmed.ncbi.nlm.nih.gov/40560663/>

Radiation Sources and Doses — U.S. Environmental Protection Agency

<https://www.epa.gov/radiation/radiation-sources-and-doses>

What is Radiation — International Atomic Energy Agency

<https://www.iaea.org/newscenter/news/what-is-radiation>