Radiation Safety

What is radiation?

Radiation is energy emitted from a source, that travels through space and can penetrate matter. Listed below are two types that we are exposed to and contribute to our overall radiation dose:

"Background"

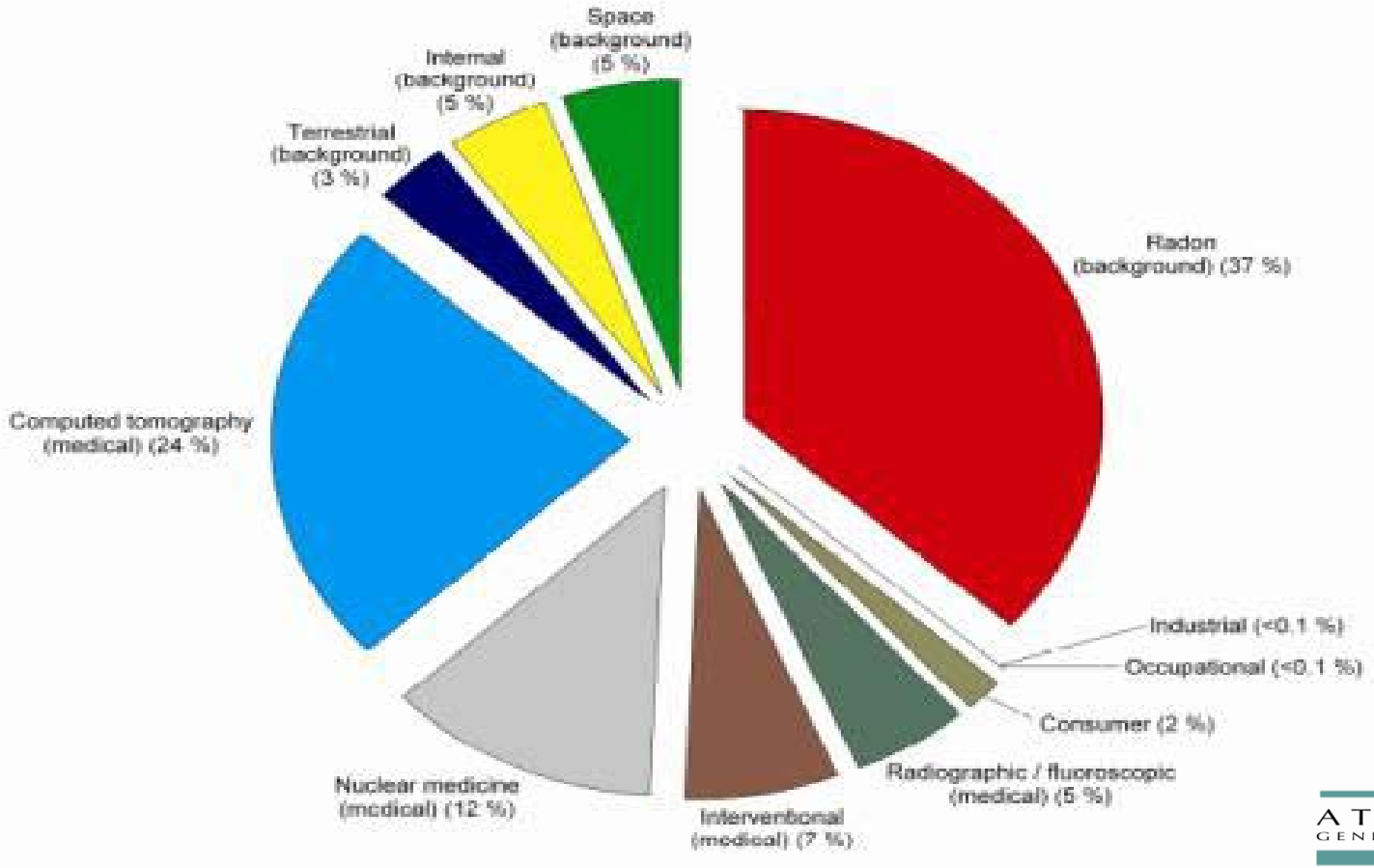
- occurs naturally in our environment, and we are all exposed to small amounts daily, from the air we breathe, the ground below, and food we eat
- Examples include air-travel, tanning/ ultra-violet light exposure, and radon found in the home

"Man-made"

- created by high-voltage devices
- Examples include medical and dental x-rays, light, microwaves and nuclear energy

http://www.iaea.org/Publications/Booklets/RadPeopleEnv/medical.html

Typical Sources of Radiation



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Radiation in Medical Imaging

- Radiation is an important and beneficial tool for treating patients:
  - **Diagnosis** of certain conditions/diseases
    - X-ray, mammography, cat-scan, and nuclear medicine are modalities that use radiation to produce images of bones and organs.
  - **Treatment** of malignant disease or malfunctioning organs, such as the use of radiation therapy.

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Types of Imaging Tests

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X-ray

- Uses electromagnetic radiation to produce images of the body, including bones, joints, and soft tissue
- Can cause tissue/cellular damage at high levels and a potential for birth defects if patient is pregnant and in 1st trimester

Fluoroscopy

- Uses radiation to generate continuous x-ray beam to video structures in motion
- Same risks as x-ray, dose may be higher for certain exams such as barium enema

Computed Tomography (CT)

- Uses radiation to acquire sectional images that can be reconstructed into several planes as well as three-dimensional images
- Similar risks as x-ray, although dose may be higher for certain exams

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Nuclear Medicine

- Uses radioactive materials to diagnose and treat various medical conditions and diseases
- Correct amount of radionuclide administered is closely monitored to avoid injury to target area

MRI

- Does not involve radiation, uses magnetic fields and radio waves to obtain a mathematically reconstructed image
- No radiological risks; although , there are contraindications when an MRI is not feasible for a patient, such as pacemakers or medical implants

Ultrasound

- Does not involve radiation, uses high-frequency sound-waves to produce images of organs and structures in the body
- No radiological risks; however, some studies are limited since bone and intestine are difficult to visualize with ultrasound

Mammography

- Uses electromagnetic radiation to image the breast to rule out cancer or make other diagnoses
- Risks are similar to x-ray; however radiation is restricted to breast

Radiation Comparison

- To put dose from medical imaging in perspective, we compare imaging dose to the time it takes to reach the same dose from natural background radiation.

- Over one year's time, our dose from natural background radiation is approximately 3 mSv

This table compares the risk of exposure to radiation in a radiology exam to an equivalent amount of exposure in natural background radiation

Procedure	Effective Dose mSv	Increased Risk of Cancer	Equivalent Period of Natural Background
No Dose			
•MRI •Ultrasound	Not defined/applicable	Not known	Not equivalent
Low Dose			
•Chest X ray •Extremities	<0.1	One in a million	Few days
Intermediate Dose			
•IVP •Lumbar spine •Abdomen •CT head and neck	1 - 5	1 in 10,000	Few months to a few years
Higher doses			
•Chest or abdomen CT •Nuclear cardiac scan •Cardiac angiogram •Barium enema	5 - 20	1 in 2,000	Few years to several years
Natural background	2.4	1 in 5,000	

https://rpop.iaea.org

Frequently Asked Questions

- **Are these x-rays going to harm me?**

  This is almost always untrue. For individual patients undergoing imaging procedures related to medical illness, the benefits far outweigh the risks.

- **After being x-rayed for a diagnostic exam, how much radiation stays in my body?**

  None. X-rays are gone as soon as the machine shuts off, in the same way that the light from a light bulb vanishes when the switch is turned off.

- **How can you best assess the beneficial uses that might expose you to radiation?**

  The best thing that you can do is, 1. Be informed, 2. Learn why you are going to receive a dose of radiation, and 3. Evaluate whether there are ways to lower the radiation.

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Sources: www.xrayrisk.com , www.radiationanswers.org

FAQ's continued …

- **If I am pregnant what is the risk to the fetus?**

  We know that children are more sensitive than adults, so a fetus is at a higher risk. If there is any chance that you may be pregnant, please inform your doctor as well as the technologist. There are precautions that may limit exposure, or there may be an alternative test that does not use radiation.

- **What is Atlantic General Hospital doing to ensure that each patient receives the lowest dose possible?**

  The imaging department has formed a committee dedicated to reducing patient exposure. This committee meets monthly to discuss different ways to lower the dose that each patient will receive during diagnostic tests. Each technologist also practices ALARA in order to reduce patient dose. ALARA means that each technologist should keep the dose as low as reasonably achievable.

Sources: www.xrayrisk.com www.radiationanswers.org

ALARA

ALARA is an acronym for As Low As Reasonably Achievable. This is a radiation safety concept for minimizing radiation dose. Our Radiologic Technologists are trained to practice these safety measures whenever possible with every patient.

The three (3) major principles to assist with maintaining doses **ALARA** are :

1) **TIME** – minimizing the time of exposure directly reduces radiation dose.

2) **DISTANCE** – doubling the distance between your body and the radiation source will divide the radiation exposure by a factor of 4.

3) **SHIELDING -** using absorbent materials such as lead for x-rays is an effective way to reduce radiation exposures.

Steps *you* can take to reduce your exposure

- **Know your medical radiation exposure history.** Keep a record of all exams – Similar to an immunization record, this information should include when and where you have had each imaging exam.
  - To ensure accurate documentation, you may use a system such as the **Atlantic General Hospital Imaging Exam History card** . By doing so, this can reduce duplicating exams and undergoing any unnecessary medical tests.
  - An accurate history can give your physician a general idea as to the amount of medical radiation that you have been exposed to in the past.

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Steps *you* can take to reduce your exposure

- Ask your health care professional how an x-ray will help. Will it help diagnose and/or determine your treatment?
- Don't insist on an x-ray. If your healthcare provider thinks one is not necessary, don't demand one
- Don't refuse an x-ray. If your healthcare provider explains why it is medically necessary, then the benefit of having the exam outweighs the small risk from radiation
- Tell the imaging technologist in advance if you are, or think you may be, pregnant.
- Ask if a protective shield can be used
- Ask **"Is my child receiving a "kid-size" radiation dose (for pediatric exams)?"**

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Questions to ask your physician before undergoing a medical imaging exam

- **"Why do I need this imaging test?"**

  If it is to diagnose or determine a treatment, then the benefit most certainly will outweigh the risk
- **"How will having this exam improve my health care?"** The result of the test may help determine the next step in your treatment or outline other possible testing options
- **"Are there alternatives that do not use radiation which are equally as good?"**

  Certain diagnoses can be obtained by other tests that do not involve radiation such as MRI and ultrasound. Ask your physician if there are non-radiation alternatives

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How does **Atlantic General Hospital** help *reduce* your medical radiation exposure?

- **The AGH Imaging Department has implemented a Radiation Safety Council named The Analyzing and Reducing Radiation Team.**
  - Educate staff, providers, and the general public regarding radiation exposure
  - Identify methods to reduce medical radiation exposure
  - Communicate appropriateness to ensure that those referred for radiological examinations really need them
  - Developed **AGH Imaging Exam History card**

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How does **Atlantic General Hospital** help *reduce* your medical radiation exposure?

- **AGH complies with accreditation standards**
  - Achieves levels of high practice standards
  - Undergoes rigorous review processes to be sure it meets nationally-accepted standards and that achievement is maintained. Findings are reported and improvements can then be made when necessary
  - Ensures personnel are well qualified through education and certification
  - Meets or exceeds quality assurance and safety guidelines

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How does Atlantic General Hospital help *reduce* your medical radiation exposure?

Radiologists

- Our physicians, certified by the American Board of Radiology, specialize in diagnosing and treating diseases and injuries using medical imaging techniques, such as x-rays, mammography, computed tomography (CT), magnetic resonance imaging (MRI), nuclear medicine, and ultrasound.

Trained Technologists

- AGH technologists are board-certified and have undergone rigorous training to ensure competence in respective imaging modalities. In areas involving radiation, protocols are established to provide appropriate dose ranges according to equipment and patient size and are closely monitored.

Equipment

- Safety, operational and functional checks are performed periodically by a licensed physicist to ensure proper calibration. Quality control programs are in place to ensure optimal equipment performance.
- Each room is equipped with technique charts to provide recommendations and protocols for exams
- Fluoroscopy equipment has a “pulsed” feature that produces fewer images per second to lower patient dose

Shields

- Lead shields utilized on all exams when possible

PACS Picture Archiving Communication Systems

- Comprehensive digital image library that is used for easy reference and comparison of imaging studies and eliminates misplaced or damaged films
- Images can be viewed within hospital and accessed at offsite facilities

Helpful Links

Image Gently

- Campaign formed by a coalition of health care organizations dedicated to providing safe, high quality pediatric imaging nationwide.

Image Wisely

- Joint Task Force on Adult Radiation Protection to address concerns about the surge of public exposure to ionizing radiation from medical imaging
- Image Wisely offers resources and information to radiologists, medical physicists, other imaging practitioners, and patients

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