

Please answer the following questions to the best of your ability. Your responses will help us to understand how you evaluate online articles that provide scientific evidence.

Will my responses be graded?

No. Your responses will be used by our research team to understand how you think critically about science.

Will my results be confidential?

The professors and researchers on our team will compile your responses for our project; no one outside of our team will have access to your responses.

You may answer the questions in any order, and you may change your responses at any time.

If you encounter problems or have questions while you are completing this pre-assessment, please raise your hand and a member of the research team will assist you.

Section 1 - Evaluating Evidence

You need to write a paper about the potential dangers of medical X-rays. A Google search leads you to the following five articles.

Article #1	Article #2	Article #3	Article #4	Article #5
<p>Title:</p> <p>The surprising effects of CT scans and X-rays</p>	<p>Title:</p> <p>What are the risks from medical X-rays and other low-dose radiation?</p>	<p>Title:</p> <p>The harmful side effects of X-rays often pose a greater risk than the original health problem</p>	<p>Title:</p> <p>X-rays: Adverse effects</p>	<p>Title:</p> <p>Are X-rays really safe?</p>
<p>Publisher:</p> <p>Consumer Reports</p>	<p>Publisher:</p> <p>The British Institute of Radiology</p>	<p>Publisher:</p> <p>Ener-Chi Wellness Center</p>	<p>Publisher:</p> <p>Wikipedia</p>	<p>Publisher:</p> <p>Medical News Today</p>

* 1. Which article are you *most likely* to use as a reference?

- The Surprising Effects of CT Scans and X-rays* from Consumer Reports
- What are the risks from medical X-rays and other low-dose radiation?* from The British Institute of Radiology
- The Harmful Side Effects of X-rays Often Pose a Greater Risk than the Original Health Problem* from the Ener-Chi Wellness Center
- X-rays - Adverse Effects* from Wikipedia
- Are X-rays Really Safe* from Medical News Today

Evaluate Article #1 -

Here is more detailed information about the first article.



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RADIATION RISKS

The surprising dangers of CT scans and X-rays
Patients are often exposed to cancer-causing radiation for little
medical reason, a Consumer Reports investigation finds

Published: January 27, 2015 06:00 AM



The following text is an excerpt from the article.

X-rays have been used for almost 120 years, but the introduction of computed tomography, or CT scans, in the 1970s, was revolutionary. The new tests, which use multiple X-ray images, allowed doctors to see with unprecedented precision the inner workings of the human body, and earned the inventors of the device the 1979 Nobel Prize in medicine. Use of the tests grew quickly, rising from fewer than 3 million per year in 1980 to more than 80 million now.

But recent research shows that about one-third of those scans serve little if any medical purpose. And even when CT scans or other radiology tests are necessary, doctors and technicians don't always take steps to limit radiation exposure.

All of that exposure poses serious health threats. Researchers estimate that at least 2 percent of all future cancers in the U.S.—approximately 29,000 cases and 15,000 deaths per year—will stem from CT scans alone.

Please examine the screenshot of the above website before responding to Questions 2-4.

If you would like more information, you may visit the website by clicking on the following link:

<https://www.consumerreports.org/cro/magazine/2015/01/the-surprising-dangers-of-ct-sans-and-x-rays/index.htm>

You are also welcome to visit other websites to support your evidence evaluation.

* 2. What is the credibility of this article?

- | | | |
|---|---|--|
| <input type="radio"/> Certainly credible | <input type="radio"/> Likely not credible | <input type="radio"/> I have no basis by which to evaluate the credibility of the article. |
| <input type="radio"/> Very likely credible | <input type="radio"/> Very likely not credible | |
| <input type="radio"/> Likely credible | <input type="radio"/> Certainly not credible | |

* 3. How likely are you to use the article as a reference for your paper?

- Very Likely Likely Unlikely Very Unlikely

4. Why or why not? Explain in 2 or 3 sentences.

Evaluate Article #2

Here is more detailed information about the second article.

The screenshot shows the top section of the BIR Publications website. On the left is the BIR logo with the text 'The British Institute of Radiology'. To its right is a large 'PUBLICATIONS' banner. Below these are navigation links: Journals, Books, CPD, Podcasts, Conference supplements, Subscriptions, and Alerts. A central banner reads 'AN INTERNATIONAL JOURNAL OF RADIOLOGY, RADIATION ONCOLOGY AND ALL RELATED SCIENCES'. At the bottom of this section are six buttons: Current Issue, Latest Articles, Previous Issues, About the Journal, Instructions for Authors, and Submit to BJR.

Home > BJR > Previous Issues > Volume 79, Issue 940 > What are the risks from m...



Review article

What are the risks from medical X-rays and other low dose radiation?

© The British Institute of Radiology

B F Wall, BSc, G M Kendall, PhD, A A Edwards, MSc, S Bouffler, PhD, C R Muirhead, PhD, and J R Meara, FFPH

Health Protection Agency, Radiation Protection Division, Centre for Radiation, Chemical and Environmental Hazards, Chilton, Didcot, Oxon. OX11 0RQ, UK

The following text is an excerpt from the article.

The magnitude of the risks from low doses of radiation is one of the central questions in radiological protection. It is particularly relevant when discussing the justification and optimization of diagnostic medical exposures. Medical X-rays can undoubtedly confer substantial benefits in the healthcare of patients, but not without exposing them to effective doses ranging from a few microsieverts to a few tens of millisieverts. Do we have any evidence that these levels of exposure result in significant health risks to patients? The current consensus held by national and international radiological protection organizations is that, for these comparatively low doses, the most appropriate risk model is one in which the risk of radiation-induced cancer and hereditary disease is assumed to increase linearly with increasing radiation dose, with no threshold (the so-called linear no threshold (LNT) model). However, the LNT hypothesis has been challenged both by those who believe that low doses of radiation are more damaging than the hypothesis predicts and by those who believe that they are less harmful, and possibly even beneficial (often referred to as hormesis). This article reviews the evidence for and against both the LNT hypothesis and hormesis, and explains why the general scientific consensus is currently in favour of the LNT model as the most appropriate dose–response relationship for radiation protection purposes at low doses. Finally, the impact of the LNT model on the assessment of the risks from medical X-rays and how this affects the justification and optimization of such exposures is discussed.

Please examine the screenshot of the above website before responding to Questions 5-7.

If you would like more information, you may visit the website by clicking on the following link:

<http://www.birpublications.org/doi/abs/10.1259/bjr/55733882>

You are also welcome to visit other websites to support your evaluation.

* 5. What is the credibility of this article?

- | | | |
|---|---|--|
| <input type="radio"/> Certainly credible | <input type="radio"/> Likely not credible | <input type="radio"/> I have no basis by which to evaluate the credibility of the article. |
| <input type="radio"/> Very likely credible | <input type="radio"/> Very likely not credible | |
| <input type="radio"/> Likely credible | <input type="radio"/> Certainly not credible | |

* 6. How likely are you to use the article as a reference for your paper?

- Very Likely Likely Unlikely Very Unlikely

7. Why or why not? Explain in 2 or 3 sentences.

Evaluate Article #3

Here is more detailed information about the third article.

The screenshot shows the website for Ener-Chi Wellness Center. At the top, there is a dark banner with the text "Special Promotion – 25% OFF Ener-Chi Art – Nov. 24th to 30th" and a "Learn More" button. Below this is a dark bar with the phone number "Call Toll-free! 1.866.258.4006" and social media icons for Facebook, Twitter, YouTube, and Google+. The main header features the Ener-Chi logo (a circular emblem with a grid) and the text "Ener-Chi Wellness Center" and "Your Trusted Source of Natural Healing Methods". A navigation menu includes links for Home, Books, Wellness Products, Free Health Info, Resources, Wholesale, About, Contact Us, and a SHOP button. Below the navigation, there is a search bar and a "Google Translate this Site" widget with a "Select Language" dropdown. The main content area displays the article title "The Harmful Side Effects of X-rays Often Pose a Greater Risk than the Original Health Problem" by Andreas Moritz, posted on September 27, 2012, with a book excerpt from "Timeless Secrets of Health & Rejuvenation".

The following text is an excerpt from the article.

One of the riskiest of all diagnostic tools is the X-ray machine. Most people who visit a doctor will experience at least one exposure to these high-frequency waves of ionizing radiation (X-rays). These are the facts that have been discovered so far about the adverse side effects of X-rays:

- Scientists have told the American Congress that X-radiation of the lower abdominal region puts a person at risk for developing genetic damage that can be passed on to the next generation. They also linked the 'typical diseases of aging, such as diabetes, high blood pressure, coronary heart disease, strokes and cataracts, with previous exposure to X-rays.
- It is estimated that at least 4,000 Americans die each year from X-ray related illnesses.

Please examine the screenshot of the above website before responding to Questions 8-10.

If you would like more information, you may visit the website by clicking on the following link:

<http://www.ener-chi.com/the-harmful-side-effects-of-x-rays-often-pose-a-greater-risk-than-the-original-health-problem/>

You are also welcome to visit other websites to support your evaluation.

* 8. What is the credibility of this article?

- | | | |
|---|---|--|
| <input type="radio"/> Certainly credible | <input type="radio"/> Likely not credible | <input type="radio"/> I have no basis by which to evaluate the credibility of the article. |
| <input type="radio"/> Very likely credible | <input type="radio"/> Very likely not credible | |
| <input type="radio"/> Likely credible | <input type="radio"/> Certainly not credible | |

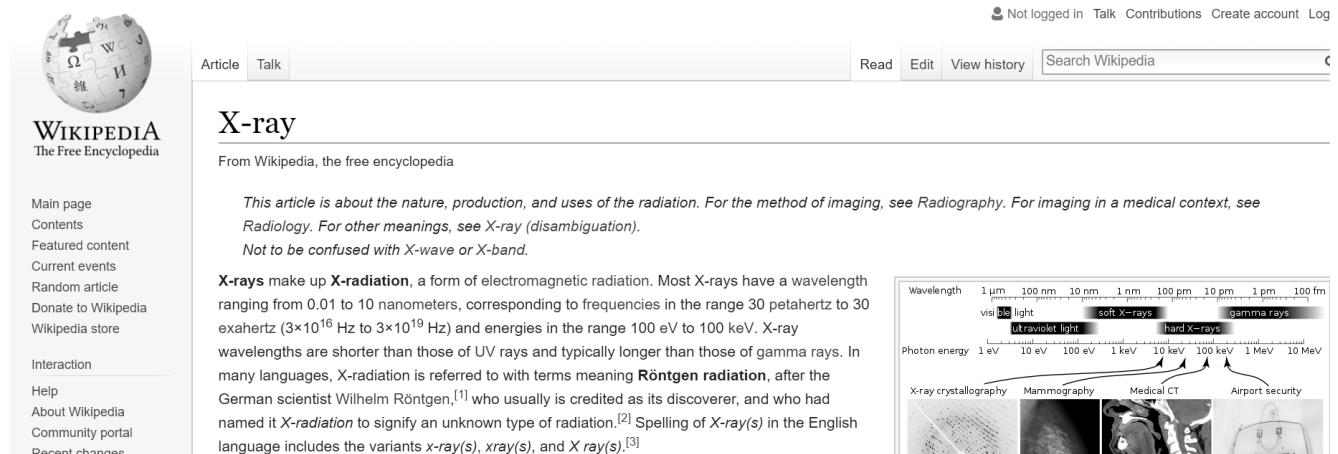
* 9. How likely are you to use the article as a reference for your paper?

- Very Likely Likely Unlikely Very Unlikely

10. Why or why not? Explain in 2 or 3 sentences.

Evaluate Article #4

Here is more detailed information about the fourth article.



The screenshot shows the Wikipedia article for "X-ray". At the top, it says "Not logged in" with links for "Talk", "Contributions", "Create account", and "Log". Below this is a navigation bar with "Article" and "Talk" tabs, and a search bar. The article title "X-ray" is prominently displayed. Below the title, it says "From Wikipedia, the free encyclopedia". The main text begins with a disclaimer: "This article is about the nature, production, and uses of the radiation. For the method of imaging, see Radiography. For imaging in a medical context, see Radiology. For other meanings, see X-ray (disambiguation). Not to be confused with X-wave or X-band." The article then defines X-rays as a form of electromagnetic radiation with wavelengths from 0.01 to 10 nanometers and energies from 100 eV to 100 keV. It mentions Wilhelm Röntgen and the term "Röntgen radiation". To the right of the text is a diagram showing the electromagnetic spectrum with wavelength and photon energy scales. It labels regions like "visible light", "ultraviolet light", "soft X-rays", "hard X-rays", and "gamma rays". Below the diagram are four small images: "X-ray crystallography", "Mammography", "Medical CT", and "Airport security".

The following text is an excerpt from the article.

Diagnostic X-rays (primarily from CT scans due to the large dose used) increase the risk of developmental problems and cancer in those exposed.[80][81][82] X-rays are classified as a carcinogen by both the World Health Organization's International Agency for Research on Cancer and the U.S. government.[73][83] It is estimated that 0.4% of current cancers in the United States are due to computed tomography (CT scans) performed in the past and that this may increase to as high as 1.5-2% with 2007 rates of CT usage.[84]

Experimental and epidemiological data currently do not support the proposition that there is a threshold dose of radiation below which there is no increased risk of cancer.[85] However, this is under increasing doubt.[86] It is estimated that the additional radiation will increase a person's cumulative risk of getting cancer by age 75 by 0.6–1.8%.[87] The amount of absorbed radiation depends upon the type of X-ray test and the body part involved.[88] CT and fluoroscopy entail higher doses of radiation than do plain X-rays.

Please examine the screenshot of the above website before responding to Questions 11-13.

If you would like more information, you may visit the website by clicking on the following link:

https://en.wikipedia.org/wiki/X-ray#Adverse_effects

You are also welcome to visit other websites to support your evaluation.

* 11. What is the credibility of this article?

Certainly credible

Likely not credible

I have no basis by which to evaluate the credibility of the article.

Very likely credible

Very likely not credible

Likely credible

Certainly not credible

* 12. How likely are you to use the article as a reference for your paper?

Very Likely

Likely

Unlikely

Very Unlikely

13. Why or why not? Explain in 2 or 3 sentences.

Evaluate Article #5

Here is more detailed information about the fifth article.

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Are X-rays really safe?

By Tim Newman | Last updated Tue 9 January 2018

Reviewed by William Morrison, MD

[What are X-rays?](#) | [Types](#) | [Risks](#) | [Side effects](#) | [Benefits](#) | [Safety](#)

X-rays are a vital imaging tool used around the globe. Since first being used to image bones over 100 years ago, the X-ray has saved countless lives and helped in a range of important discoveries.

X-rays are a naturally occurring form of electromagnetic radiation. They are produced when charged particles of sufficient energy hit a material.

Over the years, scientists have shown concern over the health implications of X-rays. After all, they involve firing radiation at the patient. But, do its benefits outweigh its risks?

This *MNT Knowledge Center* article will discuss what X-rays are, how they are used in medical science, and the level of risk that they pose.

The following text is an excerpt from the article.

X-rays can cause mutations in our DNA and, therefore, might lead to cancer later in life. For this reason, X-rays are classified as a carcinogen by both the World Health Organization (WHO) and the United States government. However, the benefits of X-ray technology far outweigh the potential negative consequences of using them.

It is estimated that 0.4 percent of cancers in the U.S. are caused by CT scans. Some scientists expect this level to rise in parallel with the increased use of CT scans in medical procedures. At least 62 million CT scans were carried out in America in 2007.

According to one study, by the age of 75 years, X-rays will increase the risk of cancer by 0.6 to 1.8 percent. In other words, the risks are minimal compared to the benefits of medical imaging.

Please examine the screenshot of the above website before responding to Questions 8-10.

If you would like more information, you may visit the website by clicking on the following link:

<https://www.medicalnewstoday.com/articles/219970.php>

You are also welcome to visit other websites to support your evaluation.

* 14. What is the credibility of this article?

- | | | |
|---|---|--|
| <input type="radio"/> Certainly credible | <input type="radio"/> Likely not credible | <input type="radio"/> I have no basis by which to evaluate the credibility of the article. |
| <input type="radio"/> Very likely credible | <input type="radio"/> Very likely not credible | |
| <input type="radio"/> Likely credible | <input type="radio"/> Certainly not credible | |

* 15. How likely are you to use the article as a reference for your paper?

- Very Likely Likely Unlikely Very Unlikely

16. Why or why not? Explain in 2 or 3 sentences.

* 17. Below are the titles and weblinks for the five sources of evidence in the order in which you examined them.

The Surprising Effects of CT Scans and X-rays

<https://www.consumerreports.org/cro/magazine/2015/01/the-surprising-dangers-of-ct-scans-and-x-rays/index.htm>

What are the risks from medical X-rays and other low-dose radiation?

<http://www.birpublications.org/doi/abs/10.1259/bjr/55733882>

The Harmful Side Effects of X-rays Often Pose a Greater Risk than the Original Health Problem

<http://www.ener-chi.com/tag/x-rays-and-cancer-risk/>











X-rays - Adverse Effects

https://en.wikipedia.org/wiki/X-ray#Adverse_effects

Are X-rays Really Safe?

<https://www.medicalnewstoday.com/articles/219970.php>

Rank these five references in order of credibility.

  <i>The Surprising Effects of CT Scans and X-rays</i> (published by Consumer Reports)
  <i>What are the risks from medical X-rays and other low-dose radiation?</i> (published by The British Institute of Radiology)
  <i>The Harmful Side Effects of X-rays Often Pose a Greater Risk than the Original Health Problem</i> (published by Ener-Chi Wellness Center)
  <i>X-rays - Adverse Effects</i> (published by Wikipedia)
  <i>Are X-rays Really Safe?</i> (published by Medical News Today)

18. During the first half of the semester you worked individually and used *sInvestigator* to look at a historical topic. Compared with the traditional lecture format, how did you learn differently during your individual work with *sInvestigator*?

19. During the second half of the semester you worked in a group and used *sInvestigator* to predict the future. Compared with the traditional lecture format, how did you learn differently during your group work with *sInvestigator*?

20. *sInvestigator* is designed to do the following:

1. Help students develop critical thinking skills in approaching scientific problems
2. Support and guide student teams as they approach the given scientific problem as ceaseless discovery of evidence, hypotheses, and arguments
3. Engage students in understanding, extending, creating, critiquing, and debating evidence-based scientific argumentations in real-life scientific investigations

In your own words, what does *sInvestigator* actually do?

21. The *sInvestigator* research team has enough money to pay the developers to make one major system upgrade. What change to the system should they make?

* 22. Please enter your first name and last name. We will use this information for matching with future surveys; your name will be removed prior to the analysis of the responses.

23. During the Fall 2018 semester, we plan to conduct interviews to further understand student experiences with sInvestigator. May we use your GMU email address to send you more information?

Yes

No

Thank you so much for participating in the study this semester, and thank you for completing this pre-assessment.

If you have further questions about the study, please email Dr. Nancy Holincheck in the Graduate School of Education at GMU, nholinch@gmu.edu