

# The LNT Issue Is About Politics and Economics, Not Safety

Dose-Response:  
An International Journal  
July-September 2020:1-4  
© The Author(s) 2020  
Article reuse guidelines:  
sagepub.com/journals-permissions  
DOI: 10.1177/1559325820949066  
journals.sagepub.com/home/dos



Jerry M. Cuttler<sup>1</sup>

## Abstract

The Sykes commentary advocates “a more sensible, graded approach for protection from low dose ionizing radiation” until the LNT dose-response issue is resolved. It urges scientists to stop criticizing the LNT model that links radiation to a risk of cancer and accept regulatory use of the threshold model to “protect” people, but with higher limits. It fails to mention the 120-year history of successful low-dose treatments of a wide variety of serious diseases, including cancers. The commentary ignores published evidence of a threshold at 1.1 Gy for radiogenic leukemia and a dose-rate threshold at about 0.6 Gy per year for lifespan shortening. LNT came from politicized science, replete with scientific misconduct and conflict of interest. Its acceptance created a false cancer scare that was likely intended to stop atomic bomb testing, but it has severely damaged human welfare. Many vitally important low-dose therapies were discarded when the radiation scare was disseminated in 1956. The rapid growth of nuclear energy ended with the media-inflamed public panic after the Three Mile Island accident in 1979. Extreme implementation of the precautionary principle made it uneconomic. Availability of a low-dose therapy for lung inflammation could have dramatically decreased the impact of the COVID-19 pandemic.

## Keywords

LNT model, ionizing radiation, low-dose radiation medical therapies, nuclear energy, precautionary principle, radiophobia

The Sykes commentary advocates “a more sensible, graded approach for protection from low dose ionizing radiation” until there is a resolution of the linear no-threshold (LNT) dose-response issue. It urges scientists to stop criticizing the LNT model and just accept regulatory use of the threshold model to “protect” people, but with higher limits.<sup>1</sup> Intentionally, the LNT idea connects radiation to a risk of cancer; it leads to the requirement to minimize any exposure; it communicates a sense of danger. The commentary agrees “there is no consistent evidence to support increased cancer risk in humans at doses below an acute 100 mGy (0.1 Gy) dose and even higher doses at low dose rate.” It acknowledges the permissible levels for man-made radiation of < 1 mSv per year for the public and < 20 mSv per year for a worker.<sup>1</sup> These levels are specified in the “effective dose” unit, sievert, the radiation protection measure of health (cancer) risk.<sup>2</sup> However, the commentary does not address the real problem with the LNT concept, which is the political linkage of ionizing radiation to a risk of dreaded cancer death.

The commentary fails to mention the 120-year history of successful medical treatments with low doses of radiation for a wide variety of diseases, including cancer. (In reference 3, the author defined a *low dose* as a dose below the threshold of the

onset of early and late adverse effects). There were no reports of radiogenic cancers among patients. In 1925, the safe dose-rate limit for radiologists was 0.2 roentgen per day or about 0.7 Gy per year. It was lowered to 0.3 Gy per year in 1934 and ratcheted down progressively to the present values, driven solely by changing attitudes toward acceptable risk, not by scientific evidence of health effects. Many successful clinical trials were carried out in the 1980s and 1990s using low doses of radiation to cure cancer, and there have been several case reports recently on successful treatment of serious diseases, employing low doses of radiation.<sup>3</sup>

Analyses of radium dial painter data revealed an intake threshold of 100 µg for malignancy and a 10 Gy threshold for bone cancer.<sup>3</sup> Nasopharyngeal radium irradiation therapy was employed widely from 1940 through 1970 on between 0.5 and

<sup>1</sup> Cuttler & Associates Inc, Vaughan, Ontario, Canada

Received 22 May 2020; received revised 10 July 2020; accepted 16 July 2020

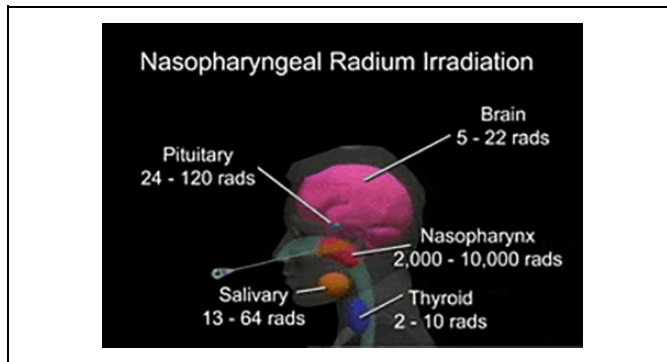
## Corresponding Author:

Jerry M. Cuttler, Cuttler & Associates Inc, 1104-11 Townsgate Drive, Vaughan, Ontario, Canada L4J8G4.

Email: jerrycuttler@rogers.com



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).



**Figure 1.** Radiation dose delivered to nearby organs during nasopharyngeal radium irradiation therapy.<sup>4</sup> The radiation doses (1 rad = 0.01 Gy) to nearby organs (in adults) were estimated on the basis of 50 mg of radium-sulfate in two 0.5 mm platinum capsules for 12–60 minutes per session for 3 sessions.<sup>4</sup>

2.5 million children and at least 8000 military personnel to shrink swollen tissue in the nasopharyngeal cavity (to remediate adenoid inflammation and ear dysfunction). Although the dose was rather high, Figure 1, the many worldwide studies carried out on these patients did not confirm a definite link between these treatments and any disease.<sup>3-5</sup> This strong evidence contradicts the consensus opinion that children are especially sensitive to radiation. A reanalysis of the leukemia data of the Hiroshima atomic bomb survivors revealed an acute dose threshold at about 1.1 Gy for initiation of this cancer in blood-forming stem cells, which are more radiosensitive than other cell types. The incidence of this cancer was only 0.5% of the 10,000 survivors who were located in Zones A and B.<sup>3</sup> Analysis of a study that exposed dogs, lifelong, to cobalt-60 radiation provided evidence of a dose-rate threshold of about 0.6 Gy per year for life span reduction.<sup>6</sup> The experience of 134 workers who were heavily irradiated during the 1986 Chernobyl reactor accident indicates a dose threshold of about 5 Gy for acute mortality (28 workers). Follow up of the 106 workers who recovered showed no evidence of increased mortality or increased cancer mortality over a 30-year period.<sup>3</sup> This contradicts the LNT assumption of increased risk of delayed health effects due to any radiation exposure.

The LNT model of fruit-fly mutations versus radiation dose began as a scientific model, but it became a political model in 1946 when Muller and Stern disregarded and suppressed evidence that contradicted it.<sup>7</sup> More importantly, Muller also suppressed the *human* evidence of a study on the atomic bomb survivors that contradicted the LNT model.<sup>8</sup> The history of the 1956 U.S. National Academy Science (NAS) recommendation to the world to use the LNT model to assess the risk of radiation-induced mutations is replete with scientific misconduct and scandal.<sup>9</sup> The Rockefeller Foundation derived its wealth from petroleum energy; it had a clear conflict of interest while managing the NAS BEAR I Genetics Panel, which linked radiation from nuclear energy to genetic mutations.<sup>10,11</sup>

Radiation was soon linked inappropriately to a risk of cancer.<sup>12,13</sup> The low-dose radiation medical therapies were phased out after the extreme LNT radiation scare was disseminated.<sup>3</sup>

The NAS action is likely linked to antinuclear activity against the incessant testing, intensive development, and massive production of nuclear weapons during the Cold War period that followed WWII. Many of the scientists who participated in developing these weapons understood their capabilities and were genuinely concerned about the possibility of a global nuclear war. Since the radioactive particles or fallout from the bomb tests were spreading over the whole planet, instilling social fear of radiation was a way to stop the preparations for atomic warfare. They were joined by other scientists and this developed into political opposition against all things nuclear.<sup>14,15</sup>

The rapid growth of nuclear energy in the U.S., about 100 plants, ended with the media-inflamed panic that followed the Three Mile Island accident in 1979. Extreme implementation of the precautionary principle during the 1986 Chernobyl accident led to massive evacuations, widespread screening for thyroid cancer, unnecessary thyroid surgeries and abortions, and exaggerated LNT estimates of delayed cancer deaths.<sup>15-17</sup> The Great Tohoku Earthquake and tsunami of 2011 damaged 3 reactors at the Fukushima plant. The death toll from the natural disaster was about 20,000; however, attention focused on the radioactive particles that escaped from the reactors. As a precaution against health effects, more than 150,000 people were evacuated to avoid exposures comparable to those received by people living in areas of elevated natural radiation. According to the Reconstruction Agency, 1632 people who had survived the earthquake and tsunami were confirmed dead as of March 31, 2012.<sup>18</sup> The social costs of the evacuation and the economic costs of the nuclear energy shutdown in Japan have been enormous.

From the 1970s, the strong growth of radiation protection, nuclear risk assessment, nuclear regulation and environmental protection have increased the cost of nuclear plants at least 10-fold and the duration of each nuclear project by a decade. The political opposition reflects the social fear. Nuclear energy is being phased out in the U.S. and in several European countries. The precautionary approach has now forced the shutdown of the Indian Point power plant. The emergency measure of evacuating New York City is unacceptable. For many decades, environmental scientists have been raising health concerns about the “safe” management of radioactive wastes and used nuclear fuel. Political leaders in Michigan have been objecting to the disposal of radioactive material 800 meters underground in Canada because of the risk of cancer from drinking Lake Huron water.

The concern about radiogenic cancer extends to the medical profession, where all physicians have been taught the LNT ideology.<sup>3</sup> They are generally committed to the notions of “imaging wisely” and “imaging gently” to minimize exposures to diagnostic X-rays.<sup>19,20</sup> Radiotherapy is accepted only for destroying malignancies. Therapies with low doses of ionizing radiation against important diseases are shunned—they are

politically unacceptable, even when evidence of their efficacy and safety is presented.<sup>3</sup>

Having enshrined this radiation-cancer risk model, government regulators now cannot deviate from LNT unless the medical community accepts a different dose-response model. The evidence of dose and dose-rate thresholds, and the evidence of beneficial effects below these high levels need to be shown to physicians and the public. How else to convince them that most radiation exposures are safe? A graded approach to increase the regulatory threshold above 1 mSv per year will not lessen the extreme fear of radiation.

The world is now coping with the COVID-19 pandemic that has infected more than 16 million and killed more than 655,000 people as of July 28th 2020.<sup>21</sup> The precautionary measure of “lockdown,” to avoid widespread infections and deaths, has severely damaged the economies of the United States and many other countries. The most critical symptom, acute respiratory distress syndrome (ARDS), resembles the inflammation of viral pneumonia. A 2013 review pointed out that many types of pneumonia were treated successfully from the mid-1920s to the mid-1940s by an anti-inflammatory dose of X-rays to the lungs. It recommended the creation of a focused clinical research program that could assess the use of X-ray therapy for pneumonia as an adjunct treatment for high-risk patients.<sup>22</sup> No such program was carried out, even though pneumonia is a major cause of death in individuals aged 65 and older.

A March 20, 2020 letter to the U.S. Food and Drug Administration urged its support for a clinical trial of this anti-inflammatory therapy for COVID-19 induced pneumonia (Supplemental material).<sup>23</sup> This letter reached many radiation oncologists and several of them submitted proposals for clinical trials. The case for institutional review board approval of this controversial intervention could be based on a comparison of the 0.5 Gy dose for this treatment and the 60 Gy total dose of 30 fractions of 2 Gy that is typically employed in the radiotherapy of lung cancer. Thousands of COVID-19 patients are dying each day, mostly due to ARDS. Fortunately, clinic trials are now underway in several countries,<sup>24</sup> supported by a revised assessment of efficacy and safety.<sup>25</sup> Preliminary results from a clinical trial in Iran on 5 patients indicated this therapy may be as effective as it was in the 1940s against viral pneumonia.<sup>26</sup> It is important to note that 40 dying patients were invited to participate, but only 5 agreed. The other 35 chose to risk death rather than accept the perceived risk of a low dose of radiation. Preliminary results from the Winship Cancer Institute, Emory University are encouraging.<sup>27</sup>

In conclusion, humanity has been paying an enormous price for government retention of the LNT policy. The Sykes recommendation to stop criticizing the use of the LNT model for radiation protection will not solve this problem because it does not address the unwarranted fear of cancer.


### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

### ORCID iD

Jerry M. Cutler  <https://orcid.org/0000-0001-9532-9818>

### Supplemental Material

Supplemental material for this article is available online.

### References

1. Sykes PJ. Until there is a resolution of the pro-LNT/anti-LNT debate, we should head toward a more sensible graded approach for protection from low-dose ionizing radiation. *Dose Response*. 2020;18(2):1-4.
2. Fisher DR, Fahey FH. Appropriate use of effective dose in radiation protection and risk assessment. *Health Phys*. 2017;113(2):102-109.
3. Cutler JM. Application of low doses of ionizing radiation in medical therapies. *Dose Response*. 2020;18(1):1-17.
4. Centers for Disease Control and Prevention. Radiation and your health, NRI: General Information. U.S. HHS 2014. Accessed July 28, 2020. <https://www.cdc.gov/nceh/radiation/nri/default.htm>
5. National Cancer Institute. Nasopharyngeal radium irradiation (NRI) and cancer: Fact sheet. U.S. HHS NIH 2003. Accessed July 28, 2020. [https://stacks.stanford.edu/file/druid:st370yg4366/Fs3\\_87.pdf](https://stacks.stanford.edu/file/druid:st370yg4366/Fs3_87.pdf)
6. Cutler JM, Feinendegen LE, Socol Y. Evidence of a dose-rate threshold for life span reduction of dogs exposed lifelong to  $\gamma$ -radiation. *Dose Response*. 2018;16(4):1-5.
7. Calabrese EJ. On the origins of the linear no-threshold (LNT) dogma by means of untruths, artful dodges and blind faith. *Environ Res*. 2015;142:432-442.
8. Calabrese EJ. The Muller-Neel dispute and the fate of cancer risk assessment. *Environ Res*. 2020. In press.
9. Calabrese EJ. LNTgate: the ideological history of cancer risk assessment. *Toxicol Res Appl*. 2017;1(1):1-3.
10. Calabrese EJ. The linear no-threshold (LNT) dose response model: a comprehensive assessment of its historical and scientific foundations. *Chem Biol Interact*. 2019;301:6-25.
11. National Academy of Sciences (NAS)/National Research Council (NRC). The biological effects of atomic radiation (BEAR): a report to the public. NAS/NRC, Washington. 1956. Published as, Genetic effects of atomic radiation. *Science*. 1956;124:1157-1164.
12. Lewis EB. Leukemia and ionizing radiation. *Science*. 1957;125(3255):963-972.
13. Cutler JM, Welsh JS. Leukemia and ionizing radiation revisited. *J Leukemia*. 2015;3:4. doi:10.4172/2329-6917.1000202
14. Cutler JM. Remedy for radiation fear—discard the politicized science. *Dose Response*. 2014;12(2):170-184.
15. Jaworowski Z. Radiation hormesis—a remedy for fear. *Human Exper Toxicol*. 2010;29(4):263-270.
16. Ahn HS, Kim HJ, Welch HG. Korea’s thyroid-cancer “epidemic”—screening and overdiagnosis. *N Engl J Med*. 2014;371(19):1765-1767.

17. Jaworowski Z. *Comments by Representative of Poland in UNSCEAR on The Chernobyl Forum Report. January 5, 2006. President's Special Session on Low-Level Radiation and Its Implications for Fukushima Recovery.* American Nuclear Society; 2012:131-141. Accessed July 28, 2020. [https://www.ans.org/file/1336/special\\_session-low\\_level\\_radiation-fukushima-v1.4.pdf](https://www.ans.org/file/1336/special_session-low_level_radiation-fukushima-v1.4.pdf)
18. Ichiseki H. Features of disaster-related deaths after the Great East Japan Earthquake. *Lancet.* 2013;381(9862):204. Accessed July 28, 2020. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(13\)60091-4/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(13)60091-4/fulltext)
19. Oakley PA, Harrison DE. Are restrictive medical radiation imaging campaigns misguided? It seems so: a case example of the American Chiropractic Association's adoption of "Choosing Wisely." *Dose-Response.* 2020;18(2):1-14.
20. Oakley PA, Harrison DE. Death of the ALARA radiation protection principle as used in the medical sector. *Dose-Response.* 2020; 18(2):1-12.
21. Johns Hopkins University. COVID-19 Dashboard by the CSSE. Accessed July 28, 2020. <https://coronavirus.jhu.edu/map.html>
22. Calabrese EJ, Dhawan G. How radiotherapy was historically used to treat pneumonia: could it be useful today? *Yale J Biol Med.* 2013;86(4):555-570.
23. Cuttler JM. *0.5 Gy Chest X-Ray as a Potential Remedy for COVID-19 Disease.* Letter to Hahn SM, U.S. FDA. March 20, 2020. Supplementary Material.
24. National Library of Medicine. Registry of clinical trials; COVID-19 that employ low dose radiation. ClinicalTrials.gov PRS. 2020. <https://clinicaltrials.gov/ct2/results?cond=COVID&term=low+dose+radiation&cntry=&state=&city=&dist=>
25. Dhawan G, Kapoor R, Dhawan R, et al. Low dose radiation therapy as a potential life saving treatment for COVID-19-induced acute respiratory distress syndrome (ARDS). *Radiother Oncol.* 2020;147:212-216.
26. Ameri A, Rahnama N, Bozorgmehr R, et al. Low-dose whole-lung irradiation for COVID-19 pneumonia: short course results. *Res Square.* 2020. doi:10.21203/rs.3.rs-40507/v1
27. Hess CB, Buchwald ZS, Stokes W, et al. Low-dose whole-lung radiation for COVID-19 pneumonia. *medRxiv preprint.* 2020. Accessed July 28, 2020. <https://doi.org/10.1101/2020.07.11.20147793>