**TABLE 1**
Approximate Dead-Time and Prompt Coincidence CR Limits with <10% Activity Bias

| PET scanner model | Dead-time correction factor (dead-time %) | Prompt CR (kcps) | Maximum recommended dose (MBq/kg) | |
|---|---|---|---|---|
| | | | Phantom-scan–predicted | Patient-scan–revised |
| Discovery 690 (GE Healthcare) | 1.5 (33%) | 5,000 | 11.4 | 9 |
| Discovery 600 (GE Healthcare) | 2.1 (52%) | 4,000 | 6.5 | 7.5 |
| Scintron 3D (Medical Imaging Electronics) | 1.6 (38%) | 1,500 | 2.7 | 6 |
| Gemini/Ingenuity TF (Philips Healthcare) | TBD | 2,000? | 4.6 | ? |

TBD = to be determined.

obtain higher CRs in larger patients, the correlation did not reach statistical significance because of limited sample size. This is in sharp contrast to the normalized CR per activity (kcps/MBq), which shows a significant negative correlation with patient weight (Fig. 1D) and is associated with higher CRs and DTF (and possible inaccuracy) in smaller patients when injected with a standard activity (e.g., 740 MBq), which is the current practice in many centers.

The patient scan–revised versus phantom scan–predicted doses from the original paper are summarized in Table 1 with the limited available data for the Gemini/Ingenuity TF scanners. The phantom-predicted and patient-revised values were quite similar for the first 2 scanners listed, whereas the phantom-predicted dose was substantially underestimated compared with the patient-revised value in the third scanner. This highlights the need to validate the final weight-based dosing using patient scans acquired on any given scanner. If the phantom peak CR of 2,000 kcps reported by van Dijk et al. represents the accuracy limit on the Ingenuity TF scanner, then indeed their patient data would suggest that the clinical dose should be reduced below 4.6 MBq/kg. Their scanner appears to have very high CR capability (>9,500 kcps); we recommend that they determine the dynamic range of CRs and weight-based doses that will maintain quantitative accuracy in their patients' scans.

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## Regarding "Subjecting Radiologic Imaging to the Linear No-Threshold Hypothesis: A Non Sequitur of Non-Trivial Proportion"

**TO THE EDITOR:** Kudos to *The Journal of Nuclear Medicine* for publishing "Subjecting Radiologic Imaging to the Linear No-Threshold Hypothesis: A Non Sequitur of Non-Trivial Proportion" (*1*). In this important paper, Siegel, Pennington, and Sacks clearly dissect the flaws behind the linear no-threshold hypothesis (LNTH), the model that has been the backbone of radiation safety policy throughout the world for more than 50 y. Most significantly, they clearly show the harm done by overzealous application of this flawed, inaccurate, and nonscientific model. A vigilant, rigorous, and relentless effort to reeducate the medical, scientific, and regulatory communities on the flawed science behind the LNTH; on the scientific evidence supporting the absence of radiation carcinogenesis at low doses (less than several 10s of Gy); and on the potential medical benefits of low-dose radiation due to its hormetic effects is needed, and publishing papers such as the one by Siegel et al. is a good step in that direction.

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**TO THE EDITOR:** I applaud the authors' article on the nonvalidity of the linear no-threshold hypothesis (LNTH) and the ongoing folly of its continued reliance for guiding radiation safety and diagnostic imaging dose policies (*1*). I too have been convinced for some time that the "emperor has no clothes."

The fallacy of the LNTH also partly, if not significantly, fuels the impetus of the ongoing PET/MR imaging initiative, based in part on avoiding the toxicity of the CT radiation dose attendant to the PET/CT scan (*2*). This is a misguided cost-ineffective effort of the nuclear medicine industry, in my opinion, attempting to displace more practical and well-established PET/CT imaging protocols costing one-fifth or less as much as the combined equipment and site preparation costs and affording shorter imaging protocols, and with no incremental diagnostic benefit from the use of PET/MR imaging in most cases.

Similarly, an arbitrary guideline from the American Society of Nuclear Cardiology was proposed to limit nuclear cardiology study doses to 9 mSv (*3*), without any scientific basis behind this recommendation. Such a low patient dose can be achieved only with current technology in the community setting, for the most part, using PET in lieu of SPECT imaging, at increased cost and more limited availability, despite the fact that SPECT affords near-comparable sensitivity and specificity for most patients (*4*). This is yet another misguided cost-ineffective radiation phobia–driven initiative.

As the authors pointed out in their article, abandonment of the LNTH would likely result in the elimination of many government jobs and significantly reduce the budget of the federal and state regulatory agencies, because the need to oversee and regulate such nonharmful, if not outright beneficial, low-level exposure would evaporate. Unfortunately, it is easy for such regulatory agencies to foment irrational radiophobia concerns on the part of the lay public, contributing to outrage at the suggestion of relaxing such standards.

I sincerely hope that this article will provoke a greater level of engagement by the nuclear medicine community at large, and hopefully by the Society of Nuclear Medicine and Molecular Imaging as well, to abandon the LNTH for guiding our radiation safety and imaging practices, in concert with the consensus of evidence from the literature.

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**TO THE EDITOR:** The recent article by Jeffry A. Siegel, Charles W. Pennington, and Bill Sacks (*1*) credibly demonstrates the fallacy of the linear no-threshold hypothesis (LNTH) and its illegitimate ALARA (as low as reasonably achievable) progeny as applied to medical imaging. The authors note that credible evidence of imaging-related carcinogenic risk at low absorbed dose (<100 mGy) is nonexistent. Any perceived risk is a hypothetical consequence of the presumed validity of the scientifically unjustified LNTH, and low-dose radiation does not cause, but more likely helps prevent, cancer. Siegel et al. (*1*) observe that the LNTH and associated ALARA concepts are fatally flawed and focus only on molecular damage while ignoring protective, organismal biologic responses. The article clearly illustrates the societal harm caused by the LNTH and ALARA.

The LNTH also affects acceptance of the use of radiation and radioactive materials and causes the ALARA concept to create harm rather than the presumed benefit. These concepts create a world in which ALARA becomes "A Law Against Radiation Applications." The negative societal impact of the LNTH and ALARA concept is significant (*1–5*).

Negative ramifications of the LNTH and associated ALARA concept include a limitation of research using radiation and radioactive materials, adverse impact on medical diagnoses, limitation of nuclear energy expansion in the United States and Europe, deterrence of the achievement of lower costs for radiation-related services, slowed recovery from the Fukushima Daiichi accident, and contribution to the unwarranted public fear of radiation and radioactive materials.

Radiophobia has inhibited research using low-dose radiation in the detection, prevention, and treatment of cancer and other diseases. Unwarranted fears caused by belief in the LNTH have also effectively inhibited research involving unique applications of radiation and radioactive materials. These applications include the use of low-dose radiation as a treatment protocol.

Patients have refused to undergo CT scans, and physicians are not prescribing these procedures because the LNTH has created concern about the subsequent radiation detriment. This fear could result in missed diagnoses because imaging doses are too low to produce adequate tissue resolution (*5*).

The expansion of nuclear energy in the United States and Europe has been limited because the radioactive releases resulting from Three Mile Island, Chernobyl, and Fukushima Daiichi reinforced unjustified fears regarding the effects of radiation (*4,6*). These effects include incorrect assumptions regarding the connection between cancer and hereditary effects and low doses of ionizing radiation. The associated radiophobia promotes the use of higher-cost and polluting energy-generating sources that negatively affect economic growth.

Increased regulation of radiation and radioactive materials and the associated costs to implement compliance further dampen the expansion and use of radiation and radioactive materials. Regulations affect consumer, medical, industrial, health care, and research applications and result in significantly increased costs with limited benefit.

These concerns are illustrated by a simple example of resource allocation. Nuclear facilities (e.g., power reactors and fuel cycle facilities) devote significantly more personnel and attention to radiation safety driven by LNTH/ALARA than to industrial safety. The imagined benefit of saving 10 μSv (1 mrem) leads to a larger resource allocation for radiation safety. Commonplace signs and slogans promoting the fact that "Every Millirem Counts" further reinforce LNTH/ALARA and its misguided basis. The resources devoted to saving trivial doses come at the expense of worker health and safety and prioritize radiation safety based on the LNTH/ALARA myth over industrial safety. These issues go beyond trip-and-fall hazards. The imagined radiation risk is deemed