Indeed, what has changed!

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Sir,

Thomas Slovis is among the great leaders in advancing radiation dose reduction during the last decade. However, I was disappointed that his report [1] in the recent *Pediatric Radiology* special ALARA issue perpetuated 10-year-old dogmas without re-examining their merit. Dr. Slovis' first reference is to a 2000 paper by Pierce and Preston showing that atomic bomb survivors at low doses had an increased risk of cancer. Dr. Slovis then states that "cancer risks" are available at dose levels comparable to those received by children undergoing CT. The article boldly imputes that this is proven and does not rely on any *assumptions*, *extrapolations* or *theories*. Finally, a graph is reproduced showing the alarmingly high cancer rate expected of infants and young children undergoing CT. Unfortunately, there are many errors in the above dogma. The Pierce and Preston paper grouped atomic bomb survivors who received 0–100 mSv as low dose. I do not know of any radiologist who would consider 100 mSv a low dose for a diagnostic radiology examination. This is an unacceptable level when trying to transpose results to CT examinations. An *assumption* that the linear no-threshold model *theory* will allow for *extrapolation* to low doses is used to conclude that the risk of CT will result in an increased cancer rate in children. There is also an *assumption* that the dose shielding estimates for atomic bomb survivors used to assign individual effective doses in the Pierce and Preston paper are incontrovertible. In fact, the dose estimates have been revised four times. The most recent model for dose estimation is the DS 02, which recognized that prior shielding models underestimated radiation exposure. All of the papers cited in Dr. Slovis' article

used the DS 86. Papers calculating cancer risks based on the DS 86 that preceded the DS 02 should be disregarded as obsolete.

Interestingly, Preston et al. [2] published a paper that used the correct DS 02 shielding model. This study included a group of atomic bomb survivors who received less than 5 mSv. This is a dose close to what is commonly expected in pediatric examinations performed today. Using colon dose as a marker for solid tumors, 4,270 solid tumors were found in 38,507 atomic bomb survivors who received less than 5 mSv. The expected number if they had received no radiation was 4,282. There were actually 12 fewer solid cancers than expected if the group had received no radiation at all. Using bone marrow dose as a marker for leukemia, the authors found a few more than expected cases of leukemia. In the atomic bomb survivors who received less than 5 mSv, no increase in cancer rate has been detected in more than 55 years of follow-up. That is a fact that relies on *no assumptions*, *theories* or *extrapolations*. We should be able to tell parents that to the best of our knowledge, there is no evidence linking cancer to CT examinations that result in patient exposures up to 5 mSv. Given the already long follow-up of the atomic bomb survivors, it is doubtful that any increased risk of cancer in survivors who received doses below 5 mSv would ever be detected. This does not mean that no risk exists but that we will need to find a better tool to study the problem. Longitudinal, large cohort studies of children who have previously undergone CT provide our best hope of understanding the real risk to children.

References

1. Slovis TL (2011) Where we were, what has changed, what needs doing: a decade of progress. *Pediatr Radiol* 41(Suppl 2):S456–S460
2. Preston DI, Pierce DA, Shimizu et al (2004) Effect of recent changes in atomic bomb survivor dosimetry on cancer mortality risk estimates. *Radiat Res* 162:377–389

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