Ionizing radiation exposure – more good than harm? The preponderance of evidence does not support abandoning current standards and regulations

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The following discussion is in response to a recent commentary by Oakley PA, Harrison DD, Harrison DE, Hass JW: On ''phantom risks'' associated with diagnostic ionizing radiation: evidence in support of revising radiography standards and regulations in chiropractic (JCCA 2005; 49(4):264–9).[1]

The basic premise of the Oakley et al. commentary is that the linear-no-threshold risk model and current radiation exposure guidelines are based on faulty or inadequate science; that low levels of radiation actually offer beneficial health effects (radiation hormesis) rather than posing health risks; and that current guidelines aimed at limiting radiation exposure to levels as low as reasonably achievable should be abandoned.

There are several compelling reasons why this commentary lacks credibility.

The most important reason is that the authors provide a biased and unscientific evaluation of the evidence. They selected a few observational studies to support their position and ignore the vast body of scientific evidence that overwhelmingly opposes their view. Most notably, the authors make light of the National Academy of Sciences' recently released BEIR VII report, which is an in-depth, systematic and exhaustive study of the health risks from exposure to low levels of ionizing radiation.[2] The studies used for this report included the latest cancer incidence data from the atomic bombings in Japan at the end of World War II, as well as new dose information from medical, occupational and environmental exposures. The report indicated that the abundance of data currently available has reduced sampling uncertainties inherent in previous reports, and adds further support to the 'linear-no-threshold' risk model of cancer risk from ionizing radiation exposure. In short, this report concludes that ionizing radiation is dangerous even at low doses and that there are no safe limits. The report also supports the previously reported magnitude of estimated cancer risks for total cancer mortality and leukaemia.

Evans and colleagues[3] also believe that diagnostic radiology in general is responsible for 1% of cases of leukaemia and at least 1% of all cases of breast cancer. A more in-depth and comprehensive study exploring cancer risk from diagnostic x-rays in the UK and 14 other developed countries[4] found that diagnostic x-ray use in the UK causes 0.6% of the cumulative cancer risk to age 75. The rate is higher in the U.S. at 0.9%, almost double that reported in 1981. In Canada, radiation-induced cases of cancer per year were estimated to be 784 (males: 406; female: 378) and the percentage of cumulative cancer risk to age 75 years attributable to diagnostic x-rays may be 1.1% (males: 1.1%; females: 1.0%).[4] (Table 1) Furthermore, colon cancer was the most common radiation induced cancer in women and second most common cancer in men. Lumbar spine, hip, and pelvic radiography have a greater risk of inducing cancer owing to the proximity of the gonads and colon to the primary beam and the need for higher radiation doses. These x-rays are said to be responsible respectively for 40 and 30 radiation-induced

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Table 1
Percentage of all cancers per year attributed to diagnostic x-rays to age 75

Country	Japan	Germany	USA	Canada	Switzerland	UK
Annual X-ray/1000	1,477	1,254	962	892	750	489
Risk (%)	3.2	1.5	0.9	1.1	1.0	0.6
Cases cancer/year	7,587	2,049	5,695	784	173	700

Adapted from: Berrington de Gonzales A, et al. Risk of cancer from diagnostic x-rays. Lancet 2004; 363:345.[4]

cases of cancer per year per million examinations in the UK.[4]

Such evidence provides the rationale for institutions such as the International Commission on Radiological Protection (ICRP), National Council on Radiation Protection and Measurements (NCRP) the United Nations, the European Commission on Radioprotection and the Canadian Atomic Energy Control Board to develop guidelines, regulations and to set legal limits for professional and public exposure to ionizing radiation. The three basic principles of radiation protection can be summarized as follows:

1 No practice involving exposures to radiation should be adopted unless it produces sufficient benefit to the exposed individual or to society to offset the radiation detriment it causes.
2 Adoption of the ALARA principle (As Low As Reasonably Achievable).
3 The regulation of exposure limits through various means: controlling the sources, applying controls at the site of utilization, and public awareness.

Based on these considerations, the maximum yearly permissible dose for workers has decreased every decade from 500 mSv (50 Roentgen Equivalent Man) in 1931 to 50 mSv in 1958 (National Council on Radiation Protection and Measurements [NCRP]).[2] The International Commission on Radiation Protection (ICRP) presently recommends a dose limit of 20 mSv per year averaged *over a period of five years* for workplace exposure and of 1 mSv per year for public exposure to all the regulated emitting practices. Presently, the *legal limits in Canada* are 50 mSv per year (mSv/yr) for professional exposure and 5 mSv/yr for exposure of the public [5]

It is this evidence that also provides the rationale for chiropractic radiologists (DACBRs) to continue to caution the profession about the responsible use and inherent risks of diagnostic ionizing radiation exposure. DACBRs, whose income is derived mainly from interpreting radiographs and other imaging studies, clearly do not benefit financially from guidelines and recommendations that limit the use of radiography – quite the opposite. DACBRs consider the education of doctors an important responsibility because it increases knowledge about the level of radiation exposure patients receive during radiographic investigations.[6]

The lack of credibility of the Oakley et al. commentary also stems from the fact that the authors have a vested financial interest in promoting routine and follow-up radiography which is an essential component of their commercialized treatment program (CBP) (see JCCA 2005; 49(4):270–96 same issue). [7] To argue that chiropractic radiologists and those pressing for more restrictive guidelines to mandate restraint in radiography use should reconsider or even reverse their opinions on the risks of ionizing radiation is transparently self-serving.

Clinical guidelines advise against routine use of spinal radiography not only because of the potential health risks but also due to the lack of clinical relevance. Like any other diagnostic test, radiography should only be considered if: a) it yields clinically important information be-

yond that obtained from the history and physical examination; b) this information can potentially alter patient management and; c) this altered management has a reasonable probability to improve patient outcomes.[8–10] While lumbar spine radiographs may slightly improve patient satisfaction for those seeking primary care for low back pain in the absence of indicators for serious spinal disease, the use of plain film radiographs is not associated with improved physical functioning, pain, disability or overall health.[11,12] Kendrick et al.[11] concluded that lumbar spine radiographs do not improve therapy but prolong treatment and reinforce the belief that the patient is unwell possibly leading to greater reporting of pain and greater limitation of activity.

There is no convincing evidence that use of radiography for spinal biomechanical assessment (other than for assessing scoliosis) is of any therapeutic value.[13–15] This would explain why (in contrast to the authors opinion), 75% of radiology departments of chiropractic colleges around the world do not teach radiographic analysis systems for detecting and treating spinal misalignments.[16] It is unfortunate that the concern for inappropriate use of radiography by chiropractors in the Netherlands prompted the government to prohibit chiropractors from owning any further x-ray equipment.[23]

Another significant consideration is the high health care costs associated with unnecessary diagnostic radiography[17–19] In the US, over $500 million are spent each year on lumbar radiography alone[20] and in Ontario, the Ontario Health Insurance Plan spends annually over $16 million dollars on physician requested imaging for low back pain.[21] Such added cost is unlikely to offset small increases in patient satisfaction, especially when considering potential risks of ionizing radiation exposure and lack of demonstrable benefit to patients.[22]

In summary, the Oakley et al. commentary is little more than a biased, unscientific and self serving argument for promoting the routine use of radiography by chiropractors. Such promotion, with such inconclusive evidence may be viewed as professionally irresponsible by the scientific and academic community. To insinuate, in addition, that radiation exposure provides more good than harm adds further insult to injury.

Chiropractors must demonstrate responsible use of diagnostic imaging. They must be leaders in reducing unnecessary ionizing radiation from diagnostic imaging. For the sake of patient safety, professional responsibility and credibility within the scientific community the chiropractic profession must take it upon itself to reduce unnecessary radiography-or we may find that someone else will do it for us.

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