

The Boice Report #59

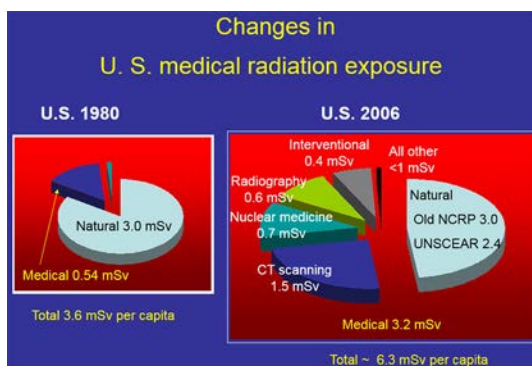


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Beneficial Radiation—How Much Is There?

National Council on Radiation Protection and Measurements (NCRP) [Report No. 160](#), *Ionizing Radiation Exposure of the Population of the United States*, showed that from 1980 to 2006 there had been remarkable growth in the exposure of the U.S. population to medical radiation. This was



Graphic courtesy of Fred Mettler, modified from NCRP Report No. 160

primarily due to increases in computed tomography (CT) scanning and cardiac nuclear medicine procedures. For the first time, medical radiation became the number-one source of exposure to the U.S. population, surpassing ubiquitous natural background radiation (see pie chart at left). This report contributed to major efforts to educate referring clinicians and providers in appropriate uses of radiation (e.g., [Image Wisely](#)[®], [Image Gently](#)[®], [Choosing Wisely](#)[®], [American College of Radiology](#) and Medicare Appropriateness Criteria, and the [Bonn Call for Action](#)). There have been major advances in imaging modalities and detector technologies; expansion of digital techniques; increases in positron emission tomography (PET)/CT, cardiac CT, and PET/magnetic resonance imaging (MRI); guidance on appropriate CT protocols and administered activities in nuclear medicine; new radiotherapy modalities; regulatory requirements including accreditation of advanced modalities; increasing use of conebeam CT in dental applications; shifts in reimbursement; and a number of other factors that likely have changed the landscape of the uses of radiation in medicine. A veritable plethora of increases in the uses of radiation in the healing arts!

History. NCRP's first venture to estimate the exposure of the U.S. population to diagnostic medical radiation was [Report No. 100](#). It began in 1972, had three chairmen, was finished in 1988, and was published in 1989. NCRP did a comprehensive reprise with Report No. 160, which covered all sources of population exposure in the United States. It began in 2006, was finished in 2008, and was published in 2009. [Scientific Committee 4-9](#) (Medical Exposures of Patients in the United States) was formed in 2016 and will update the medical exposure situation today. The Centers for Disease Control and Prevention (CDC) is an active collaborator, and the target date to publish is 2018. Based on new literature and updated medical databases, the committee has begun assessing the number and types of procedures, the average per caput and collective effective doses, and the changes since 2006.

Cochairs [Fred A. Mettler, Jr., MD](#), and [Mahadevappa Mahesh, PhD](#), have initiated innovative approaches for accessing and summarizing the vast amount of information available. The first meeting was held in Bethesda, Maryland, in April 2017 (see photo on next page). Partnership with the CDC has enhanced NCRP's ability to move quickly and with high quality.

Medical Practices and Sources of Information. The committee will use peer-reviewed published data, official government data, data from insurance companies and commercial sources (see NCRP No. 160), and data from newly available sources. Sources of information include:

- Commercial ([IMV Benchmark](#)).
- [Medicare](#) payment data.
- [U.S. Department of Veteran Affairs \(VA\) Health Care System](#).
- Claims data from large national employer plans.
- [U.S. Food and Drug Administration \(FDA\) dental data](#).
- [Conference of Radiation Control Program Directors](#) (state radiation control programs).
- [American College of Radiology](#).
- Large hospitals.

- Other industry sources.
- Peer-reviewed literature.
- [Nuclear medicine](#).
- Radiation oncology.
- Cardiology.
- Pediatrics.
- Interventional radiology.
- CDC.
- Chiropractic radiology.

Estimates of effective doses will come from common procedures as well as from high-dose but less common procedures. Age at exposure data will be included when available.

Focused Approach. The report will:

- Be a baseline data document describing sources and magnitude of doses.
- Describe changes over time.
- Not make judgments about increases or decreases being good or bad.
- Not make radiation protection recommendations.
- Quantify changes in the effective dose, which is particularly challenging.

Effective Dose. Challenges of using the effective dose are as follows:

- Effective dose data are collected for specific procedures from the peer-reviewed literature and national reports. However, the published values vary widely so judgment is still needed to choose the best (informed) effective dose. For example, virtual colonoscopy has published values that range from 4 to 13 mSv. NCRP No. 160 chose 10 mSv as the proper value based on averaging and judgment.
- Some of the complexities involve the new tissue-weighting factors that appear in the [International Commission on Radiological Protection \(ICRP\) Publication 103](#). Fortunately (for the committee), they are not generally used today. Nonetheless, effective dose will be computed using the old weighting factors and the new. The old will be important for comparison with the 2006 publication.
- Concerns include various effective-dose computations based on the ability of computer phantoms to account for obesity, sex, age, and other factors that are not along the lines of the current ICRP definition for effective dose. The committee will delineate some of these concerns for future reports.
- Effective dose is a unit for radiation protection and compliance. It is also used for comparison of different exposure circumstances. It is not a measure of harm or risk. It is an age- and sex-weighted dose for a reference person and not an individual. Effective dose is a nominal unit of detriment for radiation protection and not radiation risk. Nominal means “in name only” and “not real.”

NCRP SC 4-9: Medical Exposures of Patients in the United States 25–26 April 2017, Bethesda, Maryland



Front row, left to right: Henry Royal (Mallinckrodt Institute of Radiology), Wesley Bolch (University of Florida), Robert Sherrier (VA), David Spelic (FDA), Kathryn Held (NCRP), and Jennifer Elee (Louisiana Dept of Environmental Quality); standing, left to right: Charles Chambers (Pennsylvania State University, Hershey Medical Center), James Smith (Smith & Braselton, LLC), Fred Mettler, Jr. (University of New Mexico), John Boice (NCRP), Donald Miller (FDA), Mythreyi Bhargavan Chatfield (American College of Radiology), Donald Frush (Duke University Medical Center), Gary Guebort (Logan University), Michael Milano (University of Rochester Medical Center), Mahadevappa Mahesh (Johns Hopkins University), and Richard Vetter (Mayo Clinic)

Photo courtesy of Beverly Ottman