



Summary of NCRP 2018 Annual Meeting, *Radiation Protection Responsibility in Medicine*

The 54th Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP) was held at the Hyatt Regency Bethesda, Maryland, on 5–6 March 2018. This annual meeting, entitled “Radiation Protection Responsibility in Medicine,” was the first to deal entirely with radiation protection in medical imaging since the 43rd Annual Meeting in 2007 (“Advances in Radiation Protection in Medicine”). The 2018 meeting addressed updates for various modalities as well as including discussion on radiation dose metrics, and benefit/risk dialogue. In addition, the 2018 meeting dedicated entire sessions to patient communications and innovations in medical imaging.



John Boice, Larry Dauer & Donald Frush

The program co-chairs were Lawrence T. Dauer and Donald P. Frush. The program committee consisted of Linda A. Kroger, Fred A. Mettler, Jr., Donald L. Miller, Julie E.K. Timins, and Pat B. Zanzonico. Throughout the program development, the “responsibility” aspect of the meeting title was emphasized in both speaker expertise and topic content. The inclusion of the word “responsibility” implied a deeper perspective than just reporting factual information. The aim was to emphasize the need for authority and accountability in ionizing radiation use in medical imaging.

Continued initiatives for the meeting included the NCRP/Radiation Research Society Scholars-in-Training Program, publication of the annual dinner presentation, web links to the conference content, and question and answer engagement through written submissions following each session. One substantive change in the program was an emphasis on shorter presentations of 12–15 min each. This was in keeping with current adult learning models showing improved attention through shorter presentations with concise and targeted information. It was especially felt that shorter focused presentations were a necessary adjustment to make because of the breadth of content for diagnostic imaging and radiation therapy, inclusive of the various modalities, with the opportunity to discuss dose, benefits, risks, innovation, and communication strategies. This shorter talk structure afforded 25 presentations in addition to the three named lectures: the Lauriston S. Taylor Lecture, the Warren K. Sinclair Keynote Address, and the Thomas S. Tenforde Topical Lecture. There were a total of 18 session presentations, all with two moderators as well as four introductory summary sessions. Each presenter discussed, briefly, background and justification for the medical topic, updates in the last decade, current obstacles and opportunities, as well as the role of NCRP. Speakers and moderators did a superb job of keeping on time and allowing for what ended up being very dynamic question and answer sessions following each set of presentations. The overall meeting structure provided a rather successful template for this meeting that could be considered useful for future meetings.

The program was divided into the following: Monday's program consisted of the opening session, the 15th Sinclair Keynote Address, sessions on Dose, Benefit, Risk and Safety, Diagnostic X-Ray Imaging, Nuclear Medicine & Radiation Oncology and Dialogue and Shared Decision Making, concluding with the 42nd Taylor Lecture on Radiation Protection and Measurements. The Tuesday half-day sessions consisted of the 2nd Tenforde Topical Lecture, a fascinating session on Fostering Innovations, and ended with Conclusions and a Path Forward.



Kimberly Gaskins

As last year, Kimberly Gaskins from the U.S. Nuclear Regulatory Commission provided a deeply resonant rendition of the national anthem, against the backdrop of the presentation of the colors by the Joint Armed Forces Honor Guard from the Military District of Washington, D.C. to open the meeting, followed by the Welcome by NCRP President, John Boice. The prevailing viewpoint throughout the meeting was the human narrative, and this perspective was emphasized early, with an introduction by Kate Niehaus, from the Memorial Sloan Kettering Cancer Center Patient and Family Advisory Council for Quality, who discussed the patient view on radiation use in medical imaging and encouraged a concentration on effective dialogue with patients.

The 15th Annual Warren K. Sinclair Keynote Address was delivered by Marvin Rosenstein with elements including a focused discussion on the medical benefits to patients rather than caregivers or societal benefit. The core message of the use of ionizing radiation in medical imaging was that it needs to be justified and commensurate, noting "it is prudent to properly manage organ doses to all patients at all times." There was a discussion of available appropriateness guidelines, including those from the American College of Radiology (ACR), Royal College of Radiology, European Commission on Radiation Protection, International Commission on Radiological Protection, and NCRP. Further discussion involved diagnostic reference levels and the evolution of these in study audit. The subsequent session was moderated by Helen A. Grogan and Lawrence T. Dauer and consisted of discussions by Fred Mettler, Jerrold Bushberg, Pat Zanzonico, and Mythreyi Chatfield. Fred Mettler described the background of NCRP Report No. 160 and discussed the current Scientific Committee (SC) 4-9 project to review contemporary medical imaging radiation doses to the U.S. public. Jerry Bushberg discussed effective dose and



Marvin Rosenstein & John Boice

alternatives, discussing the origin of effective dose and the controversies surrounding this metric. Pat Zanzonico provided discussion on benefit and risks, with a particular emphasis on assessing and recognizing the benefit side of the equation. There was presentation of formulaic attribution on risk, as well as a checklist as guidance for consideration of dose/risk benefit. Mythreyi Chatfield gave a review of quality and safety initiatives, including ACR Imaging 3.0, Choosing Wisely[®], available accreditation for imaging modalities, appropriateness criteria and practice parameter resources as well as a brief review of the ACR Dose Index Registry. In addition, legislations such as XR29, and the Medicare Improvement for Patients and Providers Act were noted in addition to patient engagement efforts such as through the Radiological Society of North America RadiologyInfo, Image Gently[®], and Image Wisely[®].

The subsequent session co-chaired by Linda Kroger and Mahadevappa Mahesh dealt with specific modalities and consisted of presenters Anthony Siebert, Cynthia McCullough, and Alan Lurie. Tony Siebert discussed radiography advances such as photon counting detectors, flat-panel technology, wireless technology, and fluoroscopic advancement. The difficulties with digital radiography including dose creep were noted. He advocated for NCRP to guide on digital projection radiography and concluded that all digital imaging can be lower dose and more efficient although lower doses are not always achieved. Cynthia McCullough took the attendees through a focused tour of the technical advances of computed tomography (CT) starting with the development of spiral CT in 1991. She discussed wider detector arrays, dual-source technology, and some of the advancements providing very low doses such as cardiac CT now being in the range of just a few millisievert versus more than 10 mSv from just over a decade ago. Discussion included automatic tube current and tube potential modulation as well as iterative reconstruction. A display of achievable doses over the past 3.7 decades was illustrated, with remarkable improvements. She did caution about the potential for over aggressive dose reduction limiting diagnostic value. She also noted during the question and answer period that there was still a substantial amount of work to be done with cone-beam CT in terms of understanding dose and appropriate use. Alan Lurie discussed radiation doses for current dental imaging examinations, including the frequency of dental imaging which is now more than a billion exposures annually in the United States. His presentation included information on panoramic imaging with special emphasis on cone-beam CT, what can be achieved from a diagnostic standpoint with relatively low dose, and what are some of the challenges. Shielding was also discussed in addition to some practical guidance for radiography and cone-beam CT use.

The session on Nuclear Medicine and Radiation Oncology was chaired by Polly Chang and Pat Zanzonico. Speakers included George Sgouros, Frederick Fahey, Melissa Martin, and Bruce Thomadsen. George Sgouros reviewed radiopharmaceutical therapy. Material included commercially available radioisotopes and some of the challenges with radiotherapy in terms of dose distribution. He also discussed combined use of external radiation therapy and radiopharmaceutical therapy. He noted that nuclear medicine was no longer just diagnostic but shifting emphasis now towards therapy. Fred Fahey delivered a review of positron emission tomography (PET) and PET CT evolution, and discussed a dose survey through the ACR registry. Dose reduction strategies were provided in addition to some

discussion on PET magnetic resonance and single-photon emission CT. Melissa Martin discussed current external radiation therapy technology, including what is commercially available and discussed new techniques, technologies, and shielding challenges. Bruce Thomadsen presented brachytherapy, emphasizing the need for correct dose, correct location, and delivering a quality dose safely.



John Boice & Hans-Georg Menzel

The equally dynamic final session Monday afternoon on Dialogue and Shared Decision Making was co-chaired by Julie E.K. Timins and Randall N. Hyer. Speakers consisted of Jessica Wieder, Lawrence Dauer, Kimberly Applegate, and Maria Perez. Of note, this session embellished the prevailing attitude of the responsibility of radiation protection and the importance of dialogue. Jessica

Wieder from the U.S. Environmental Protection Agency discussed ethos, pathos, and logos as elements of strategies for dialogue and communication and challenged the professions to use personalization in communication. Larry Dauer talked about perceptions of patients and members of the public on radiation, and reviewed a survey of patients demonstrating mixed knowledge, but with an interest in risk discussions. Examples were given of how we often communicate poorly as well as emphasizing the need for presenting evidence with simplified content in two-way dialogue with patients. Kimberly Applegate dealt with dialogues in the emergency medicine arena, emphasizing the patient-centered approach, patient portals, fast results, patient advocacy, patient safety organizations, and the need to partner with emergency medicine physicians on shared decision making. She also discussed barriers in communication. Maria Perez from the World Health Organization reiterated the global relevance of appropriate strategies for communication. She talked about delivery strategies and emphasized changing position from informed consent to informed decision making during the question and answer session. Randall Hyer reiterated the importance of shared decision making, patient, and storytelling.

The 42nd Taylor Lecture was given that evening by Hans-Georg Menzel. The talk, entitled Radiation Dosimetry Research for Medicine and Protection: A European Journey, was of compelling relevance to Lauriston Taylor, with a brief history of radiation with focus on dosimetry, discussing measurement principles including radiation and high linear-energy transfer radiation therapy.

On Tuesday, following the NCRP annual business meeting, Roy Shore delivered the 2nd Tenforde Topical Lecture dealing with the linear nonthreshold (LNT) model. In a well outlined and comprehensive review of NCRP SC 1-25 work, the conclusion was “based on current epidemiologic data, no notably different alternatives to the LNT model appear more practical and prudent for radiation protection purposes.” This talk was followed by an important session on Fostering Innovations co-chaired by Kimberly Applegate and Donald Miller with speakers including Ehsan Samei, Keith Strauss, and George Xu. Ehsan Samei discussed imaging focused on the patient, with “safe, high quality, consistent evidence-based and precise focus” among other elements. He talked about the complexities of the interaction of dose, image quality, and overall clinical usefulness. Keith Strauss discussed both challenges with industry partnerships as well as solutions with respect to imaging technology. He emphasized the need to consider pediatric patients during designing and configuration of software and hardware as well as setup of imaging protocols. Continued investment by manufacturers during the setup period was critical. He also emphasized the importance of training. George Xu reviewed continuous and significant improvements in computer technology in radiation dosimetry and discussed advanced modeling methods and their potential impact on future medicine.



Roy Shore

Lawrence Dauer and Donald Frush co-chaired the final session. In closing the meeting, Donald Frush summarized what was sensed to be a very successful program, again emphasizing the patient/human narrative viewpoint of the meeting and relevant responsibilities for radiation protection across many professions. This was followed by a discussion of the NCRP vision for the future and a summary of current NCRP program area committee activities by John Boice. John thanked all who attended and participated in the vibrant question and answer discussion sessions during the meeting. In addition, NCRP was especially grateful to those organizations that helped to sponsor the annual meeting, including the ACR, Fluke Biomedical-RaySafe-Landauer, GE Healthcare, Memorial Sloan Kettering Cancer Center, Philips, and Siemens.