BIG DATA WORKSHOP:

Exploring Opportunities for Radiation Oncology in the Era of Big Data
Co-sponsored by ASTRO, NCI and AAPM.

A presentation of the Big Data Workshop
at the AAPM Annual Meeting, Washington DC
August 3, 2016

Presented by:
Stanley Benedict, PhD
Professor & Vice Chair of Clinical Physics
Department of Radiation Oncology
UC Davis School of Medicine

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Overview of the American Society for Radiation Oncology–National Institutes of Health–American Association of Physicists in Medicine Workshop 2015: Exploring Opportunities for Radiation Oncology in the Era of Big Data

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Introduction: Exploring Big Data Impact on Radiation Oncology

- The GOALS of the workshop were as follows:

- 1. To discuss current and future sources of big data for use in radiation oncology research,

- 2. To identify ways to improve our current data collection methods by adopting new strategies used in fields outside of radiation oncology, and

- 3. To consider what new knowledge and solutions big data research can provide for clinical decision support for personalized medicine.

Session 1: Novel Big Data Resources in Development That Are Not Unique to Radiation Oncology

- Challenges considered from this session include the following:

- 1. How can we collect information from the many thousands of cancer patients who received RT who have been genotyped by NCI and other sources but whose treatment, dosimetric, and outcomes data are often incomplete and located in fragmented and disparate databases?

- 2. What is the most reasonable approach to harmonize toxicity data coming from large numbers of cohorts whose clinical information was collected using a variety of evaluative instruments?

- 3. How can we translate the big data gained from radiogenomics studies into a clinically useful assay to predict which patients are at greatest risk of the development of toxicities after RT with a goal to personalize and optimize treatment?

Session 2: Big Data Resources Currently Available and/or in Development Within Radiation Oncology

- Action items from this session include the following:

- 1. There is a need to develop "knowledge management" systems that are scalable and flexible, use a common ontology, and leverage data (both within and external to radiation oncology systems) to create predictive decision support solutions.

- 2. Further support is needed for the DICOM (Digital Imaging and Communications in Medicine) standards for complex RT data sets across all planning and treatment delivery platforms.

- 3. There is a need to promote a culture of safety that advances (and is mutually reinforced by) comprehensive incident reporting to improve quality assurance and safety of RT.

Session 2: Big Data Resources Currently Available and/or in Development Within Radiation Oncology (Continued)

- Action items from this session include the following:

- 4. Careful curation of data should be performed so that they are reusable by other scientists.

- 5. The creation of high-quality, publicly available data collections is needed to foster research reproducibility and allow new avenues of research by combining high quality data sets from multiple completed projects.

Session 3: Strategies to Optimize Big Data Within Radiation Oncology and Integrate Outside Resources: How Do We Help Patients?

- Important opportunities from this session include the following:

- 1. Widening the potential for interlinkage of cancer data registries and developing strategies to include analytics for a broad range of treatment approaches (widely variable dose/volume strategies);

- 2. Developing technology and adopting a culture change to enable inter-institutional pooling of data to form large analyzable databases;

- 3. Engaging with legislative and regulatory groups to find effective and inexpensive electronic methods to gather long-term follow-up data on survival, recurrence, and patient-reported outcomes while still respecting the need to protect patient health care information; and

- 4. Understanding and identifying the key clinical decisions and questions where big data can be most useful.

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Impending Challenges for the Use of Big Data

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How Will Big Data Improve Clinical and Basic Research in Radiation Therapy?

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How Will Big Data Impact Clinical Decision Making and Precision Medicine in Radiation Therapy?

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Brian D. Kavanagh, MD, MPH,[‡] and Todd R. McNutt, PhD[§]

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A Systems Approach Using Big Data to Improve Safety and Quality in Radiation Oncology

Louis Potters, MD, FACR, FASTRO,* Eric Ford, PhD,[†]
Suzanne Evans, MD,[‡] Todd Pawlicki, PhD,[§] and Sasa Mutic, PhD[‖]

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How Can We Effect Culture Change Toward Data-Driven Medicine?

Charles S. Mayo, PhD,* Joseph O. Deasy, PhD,[†]
Bhishamjit S. Chera, MD,[‡] John Freymann,[§] Justin S. Kirby,[§]
and Patricia H. Hardenberg, MD[‖]

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Needs and Challenges for Big Data in Radiation Oncology

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Karen Hoffman, MD, Co-Chair
Mary K Martel, PhD (ASTRO Science Council Chair)
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Thank You