Informatics covers not only the information technology (IT) and infrastructure required to support data collection and management but also the computer science concepts that turn data into knowledge. In radiation oncology, medical physicists need to be familiar with the basic IT infrastructure that makes it possible to transfer and transform data through clinical processes that ultimately control radiation treatment delivery. The application of informatics continues with patient outcomes. Typically, this happens through participation in national protocols (e.g. RTOG). While they provide a framework for evidence-based medicine, the data are often limited to parameters that were designed to test a pre-defined hypothesis. As the ability to acquire and distribute data increases, we may be able to adopt data mining approaches to discover knowledge, even without asking specific questions. While simple database queries can efficiently provide statistical information (e.g. the NCI Surveillance, Epidemiology and End Results, SEER), data mining seeks hidden patterns through clustering, classification, regression and association. These principles can be applied to large volumes of concisely described data sets, similar to what can be found in clinical trials. Researchers in radiation oncology informatics are developing the infrastructure to acquire large data sets. The Radiation Oncology Data Alliance (RODA) initiative aims to provide online aggregate de-identified data from participating users of the MOSAIQ EMR. Borrowing from the field of astronomy, researchers from Johns Hopkins used the SkyServer framework to build the OncoSpace project. The NCI caBIG (Cancer Bioinformatics Grid) also provides infrastructure support. Data analytics have also been developing in parallel, with researchers structuring the data collection phases to answer questions in Comparative Effectiveness Research (CER). While a majority of researchers look for links between treatment and outcome, others have used informatics to improve not only the efficiency and business of providing care but also its quality and safety, which ultimately affects outcome.

Learning Objectives:

1. Review the information technology and infrastructure required to deliver radiation therapy.
2. Understand the use of informatics in radiotherapy clinical trials.
3. Learn the basics of data mining and its applicability to radiation oncology.
4. Become familiar with the information technology that can be leveraged to improve clinical operations.