Risk-based assessment of modern radiotherapy practice: Recommendations of AAPM TG100 protocol

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Quality assurance (QA) activities as practiced in radiation therapy today are based on prescriptive guidelines recommended by professional societies such as the American Association of Physicists in Medicine (example: AAPM – Task Group (TG) 142, TG 40, TG43 etc), the European Society for Therapeutic Radiology and Oncology (ESTRO), and the International Atomic Energy Agency (IAEA). In general, these QA recommendations focus on measurements of performance characteristics of planning and delivery devices. Results of these measurements are compared with tolerance criteria set by the organizations themselves. This traditional approach to quality management (QM) is not entirely satisfactory because published analyses of adverse events (errors) that occurred in radiation therapy show that these device-centric approaches to quality management are not sufficient to protect patients against catastrophic or even minor events. An example of this is the catastrophic event that was published by the New York Times in 2010. Therefore, a comprehensive quality management and safety program should be based on an integrated approach combining process and equipment QA. Task Group 100 adopted such an approach and recommends that a comprehensive quality management and safety program in radiation therapy should be based on risk assessment for clinical processes, resulting in an integrated QM approach that involves both process and traditional equipment QA. These recommendations are radically different from the current recommendations for QM in radiation therapy given by various professional organizations.

The TG recommends the use of three industrial engineering tools for the development of a risk-based prospective QM program in radiation therapy. These are: 1) process mapping, 2) failure modes and effects analysis (FMEA), and 3) Fault tree analysis (FTA). The process mapping tool is used to design and understand a clinical process, the FMEA tool is used to prospectively identify and analyze the weak points in the process and the FTA tool is used to visualize potential locations in the process where controls can be placed so that error pathways are blocked. Information obtained from the analyses using these tools is then used to develop a risk-based QM program.

This presentation will give an overview of these tools with simple examples of the application of these tools.