EDITORIALS

The Digital Dilemma
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Physicists have overcome a great barrier in clinical medicine by contributing to the development of imaging methods that extending visibility into the human body.

However, a great challenge remains, and even today, we cannot see everything within a patient's body that can contribute to effective diagnosis and guidance of therapeutic procedures. During more than a century since the first x-ray imaging procedures many additional medical imaging modalities and methods have been developed and constantly improved.

The development contributing to what might be considered as "the second revolution in medical imaging" was the introduction of digital computers, associated technologies, and methods for image reconstruction and processing. The modern digitally- based imaging methods have greatly extended the scope of visibility within the body but have also resulted in much more complex procedures. This is because of the many variable parameters that collectively control each imaging procedure. While the goals are generally to optimize visibility for specific clinical objectives and manage risks, it is a complex process requiring extensive knowledge of physics and its application in clinical practice.

This is one of the functions within the expanding role of medical physicists.

Visibility of anatomical structures and pathologic conditions depends on a complex relationship of five specific image quality characteristics: contrast sensitivity, blurring (visibility of detail), noise, artifacts, and geometric or special aspects of the imaged area. While these characteristics apply to all imaging modalities their values and contributing factors are very different.

For the imaging methods that produce digital images, which now include all modalities, the physical structure of the digital image is a major factor in image quality. A major distinction between digital and the earlier analog imaging methods, such as film recorded x-ray images, is that digital imaging is a sampling process in which the patient's body is divided into discrete elements, voxels, and the image is an array of pixels. In virtually all imaging modalities the sample size, voxels and pixels, is an adjustable protocol factor.

The question of optimum sample (voxel and pixel) size for a specific imaging procedure depends on a complex relationship involving clinical requirements, radiation risks, and optimizing with respect to the physical characteristics of the imaging equipment for each of the modalities.

This is the Digital Dilemma faced by the medical imaging profession and addressed within the expanding role of medical physicists as they extend their knowledge and experience in support of the medical imaging procedures within the clinical environment. It requires knowledge and experience beyond the textbook and traditional classroom to include balancing the image quality characteristics with respect to the clinical requirements, and selecting the optimum voxel/pixel or tissue sample size for each clinical procedure.

One of the goals of this journal, Medical Physics International, is to publish and disseminate educational materials and methods using a variety of innovative approaches to develop learning environments for applying physics knowledge to enhance clinical medicine.