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Review paper

Moving beyond quality control in diagnostic radiology and the role of the clinically qualified medical physicist

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ABSTRACT

Quality control (QC), according to ISO definitions, represents the most basic level of quality. It is considered to be the snapshot of the performance or the characteristics of a product or service, in order to verify that it complies with the requirements.

Although it is usually believed that "the role of medical physicists in Diagnostic Radiology is QC", this, not only limits the contribution of medical physicists, but is also no longer adequate to meet the needs of Diagnostic Radiology in terms of Quality.

In order to assure quality practices more organized activities and efforts are required in the modern era of diagnostic radiology. The complete system of QC is just one element of a comprehensive quality assurance (QA) program that aims at ensuring that the requirements of quality of a product or service will consistently be fulfilled. A comprehensive Quality system, starts even before the procurement of any equipment, as the need analysis and the development of specifications are important components under the QA framework.

Further expanding this framework of QA, a comprehensive Quality Management System can provide additional benefits to a Diagnostic Radiology service. Harmonized policies and procedures and elements such as mission statement or job descriptions can provide clarity and consistency in the services provided, enhancing the outcome and representing a solid platform for quality improvement.

The International Atomic Energy Agency (IAEA) promotes this comprehensive quality approach in diagnostic imaging and especially supports the field of comprehensive clinical audits as a tool for quality improvement.

Contents

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1. Introduction

Diagnostic radiology represents the vast majority of population exposure to man-made radiation, according to the data from the UNSCEAR Report 2008 [1]. However, although this has been well proven and data demonstrate that there is even a trend for further increase, diagnostic radiology is often inadequately covered in terms of appropriate quality procedures and competent medical professionals that can guarantee its safe and effective use.

For many decades, since its introduction, diagnostic radiology only involved low complexity equipment that could deliver very small amount of radiation dose to the patient and this has created the belief than any quality assurance initiative or intervention other than system installation and service was pointless [2]. However, the technology has rapidly evolved and we are now way beyond this point, both in terms of equipment complexity, which has significantly increased, and patient dose, which can now reach very high, even deterministic values. Furthermore, the importance of accurate diagnosis for the patient management has created a new reality in which the requirements for quality have been tremendously expanded. This is the reason why the concept of quality has been completely transformed in diagnostic radiology and the well-known quality control has been replaced by a more comprehensive framework of quality, within which the clinically qualified medical physicist has a leading role, due to his/her skills and competences [3,4].

However, especially in low and middle income countries imaging equipment is often left without proper supervision of its performance for long periods, and some kind of quality assessment, in terms of performance evaluation only takes place during inspections for licencing purposes. This is certainly inadequate to ensure safe and effective performance of the equipment, let alone to ensure that a diagnostic facility provides high quality services, which, further to the component of the equipment, should include elements related to the staff and the procedures.

Under its mandate to promote the use of atomic energy for the Health, Peace and Prosperity, the International Atomic Energy Agency (IAEA) has been continuously working with its Member States to strengthen this new era by supporting the evolution of the quality requirements beyond the traditional Quality Control.

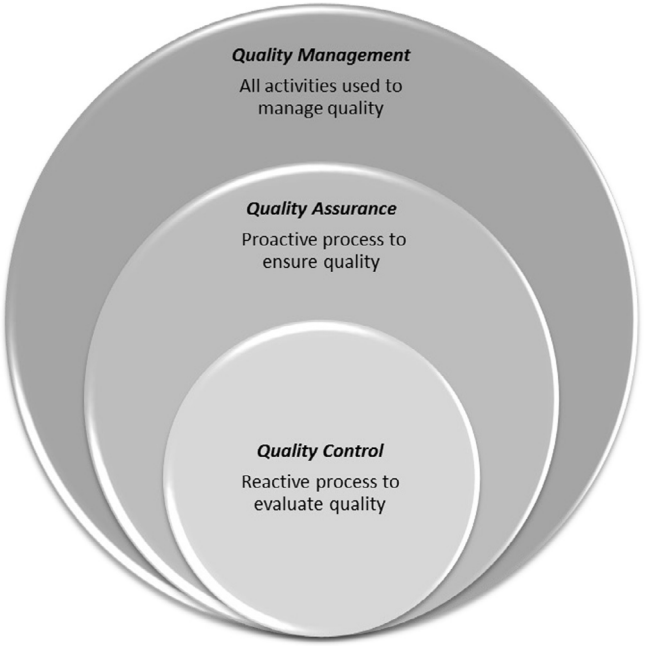

Fig. 1. Simplified structure of the System of Quality.

2. The system of quality

In order to adequately comprehend the new requirements for quality services in diagnostic radiology, one has to clearly define the term *quality*. This is done by the International Organization for Standardization [5] defining quality as "*degree to which a set of inherent characteristics of an object (product, service, process, system) fulfils requirements (need or expectation that is stated, generally implied or obligatory)*". Specifically for Healthcare, the World Health Organization (WHO) describes the six dimensions of quality that require for a Healthcare system to be [6]:

- Effective
- Efficient
- Accessible
- Acceptable/patient-centred
- Equitable and
- Safe

The structure of quality, as defined by ISO [5] has several different levels with different objectives and procedures involved. The International BSS [7], requires the existence of a management system, which is considered to "*reflect and include the concept of 'quality control' (controlling the quality of products) and its evolution through 'quality assurance' (the system for ensuring the quality of products) and 'quality management system' (the system for managing quality)*" Fig. 1.

2.1. Quality control

Quality control (QC) represents the most basic form of quality-related activities and its main objective is to ensure that *a system or a service fulfils the established quality requirements* [5]. It is thus a snapshot of the system performance and a reactive process to compare the performance against certain standards. Even though the concept of quality control is relatively well developed in the field of diagnostic radiology, there is often a misconception even at this basic level, and QC is seen only as a series of measurements on a piece of equipment. As noted by members of the Task Group 151 of the American Association of Medial Physicists (AAPM), "*Quality control in medical imaging is an ongoing process and not just a series of infrequent evaluations of medical imaging equipment*" [8].

Performance testing is just one element of quality control and represents the baseline of the structure of quality. It is just intended to verify consistently reliable and safe function of all pieces of imaging equipment. Several recommendations and guidelines have been published to support the measurement of any system performance, either in the beginning of its lifetime, or routinely to throughout its lifetime.

According to the International BSS [7], "measurements of the physical parameters of medical radiological equipment should be made by or under the supervision of a medical physicist", who, in certain cases, can delegate certain responsibilities to other staff, such as the radiological technologist.

QC is this component of quality that is frequently confused as the sole role of the medical physicist in diagnostic radiology; however, as very vividly described in the AAPM report 74 "*the vampire-physicist who only appears at night and only leaves reports is not providing appropriate service to the client*" [9].

2.2. Quality assurance

As noted even by its name the main objective of Quality Assurance (QA) is to *provide confidence (assurance) that the system will*

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