The role of the medical physics expert during the implementation of a dose management system

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Introduction

Dose management systems (DMS) are useful tools to automatically collect and analyze patient radiation doses. They provide the possibility to medical physics experts (MPE) to easily detect abnormalities and optimize exposure, without spending time and energy in collecting data. More and more hospitals are installing these tools to either fulfill legal requirements or improve quality in radiation management. Frequently, the MPE are the only professionals that understand the whole chain from law and informatics to medical physics and clinical application. Thus, they may participate to the implementation of the dose management system not only as key user, but also as consultant, project manager or a combination of the above. The aim of this work is to present the typical steps in the implementation of a DMS and examine the role and responsibilities of the MPE in each of these steps.

Methods & results

This method outlines our approach to implement a new DMS in our hospital, based on HERMES methodology (1). The methodology proposes four-phase process: 1) initiation, 2) conception, 3) implementation and 4) deployment. For clarity reasons, conception and implementation were further divided into two steps, as illustrated below. A new title that defines each step is given in bold. Important points that were treated in each phase are listed. Other points can be added according to the structure and needs of each hospital or clinic. The arrow between the flow summarizes the skills an MPE needs to have to complete the task.

1. Initiation

Why
- Stakeholders
  - MPE
  - Radiologists
  - Radiographers
  - Others (quality manager, biomedical engineers, directors, etc.)
- Economic analysis
- Legal framework
  - Radiation protection
  - Sensitive data

Objective
  - Regulatory improvement
  - Quality improvement

2a. Definition

Who and what
- Team creation
- Definition of roles in the team
- Risks for the project
  - Probability
  - Impact
  - Countermeasure
- Evaluate and choose a DMS
  - Product aspects (radiation dose, image quality, modalities, workload)
  - IT aspects
  - User-friendliness
  - Financial aspects
- Tender

2b. Planning

When and how
- Time planning for each team member
- Modalities prioritization
- Connection DMS with modalities
  - Direct connection
  - Via PACS
  - Mixed
- Collected data
  - DICOM RDSR
  - MPPS
  - Other (OCR, manually, other DICOM objects, etc.)
- Test concept/Migration concept
- Archiving

Expertise, organization, management, communication, teamwork, continuous learning

3a. Execution

Test
- Installation in test environment
- User access and rights
- Quality assurance
  - Physics
  - Data communication, transfer, access
  - DMS functionalities
- Configuration
  - DRLs
  - Alerts
  - Reports
  - Transfer to repository
- Connection with other programs

3b. Control

Go Live
- Migration from test to production environment
- Quality assurance in production environment

4. Follow-up

Working with the DMS
- Training of final users
- Management of future issues
- Final project analysis
  - Modalities connected
  - Problems encountered
  - Future actions
- Team resolution
- Data analysis
- Application of dose indicators
- Feedback

Discussion & conclusions

Due to DMS complexity, different professional teams (radiology, IT, industry, etc.) need to work together in order to install and exploit the system. Thus, implementing a DMS in a hospital needs to be treated as a project. The MPE is a key-role player in the implementation of a dose management system.

Expertise is the fundamental skill for an MPE (2); definition of needs and evaluation of DMS in phase 2, data transfer and control, configuration of the system in phase 3 and radiation exposure optimization, detection of trends and preventive actions to avoid over-exposures during phase 4 (3).

Presenting the need for a DMS to hospital managers to obtain the necessary budget, solving problems during installation and collaboration with IT or other experts need good communication skills. Organizing the project (clear definition of roles and responsibilities of team members, task prioritization, risk anticipation, etc.) is a major issue that needs to be tackled in the beginning of the project (phase 2 and 3). Managing problems that arise during system installation also demand the participation of the MPE (old modalities, incomplete DICOM reports, etc.).

Perhaps the most difficult part for the MPE is to realize that their role in dose management has evolved. This is particularly important in the case where an MPE has multiple roles and tasks. Traditional training in medical physics is based on hard skills. However, as the profession evolves, soft skills such as project, resource and costs management, communication and teamwork are becoming equally important.

Bibliography: 1) http://www.hermes.admin.ch/ 2) European guidelines on Medical Physics Expert, Radiation protection No. 174, EC 2014, 3) AAPM Medical Physics Practice Guideline 6.a.: Performance characteristics of radiation dose index monitoring systems, JACMP, vol. 18: 4, 2017
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