Enhancing patient safety by implementing a digital centralized dose management program within a large-scale healthcare organization across 13 countries and 120 CT scanners

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Introduction

**DIRECTIVES**

COUNCIL DIRECTIVE 2013/59/EURATOM

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laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom

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**Goal:**
Adapt CT practice in order to perform examinations at the as low as reasonably achievable dose for the majority of clinical indications while maintaining diagnostic image quality.
The Dose Management Program

- Improve imaging procedures by unifying & standardizing practice
- Enhance patient safety by achieving optimum radiation dose while ensuring diagnostic confidence
- Ensure regulatory compliance

Digital Centralized Dose Management Program

- 13 Countries
- >75k Scans Per Month
- 120 CT & PET/CT Systems Connected

Czech Republic
Croatia
Greece
Hungary
Ireland
Italy
Lithuania
Poland
Portugal
Romania
Spain
Switzerland
Turkey
The Digital Dose Management Process

**Standardized input**
- Standardized Protocols by clinical indication and # of irradiations with DRLs
- Standard procedures

**Radiation Dose Monitoring System**
- **GE DoseWatch**
  - Records patient data, dose data, clinical data and more
  - Flags high dose examinations

**Dose Management & Optimization**
- Culture of Dose Awareness
- Training
- Identify improvement actions
- Optimize protocols
- Monitor KPIs

Dose Excellence
BALANCED RADIOTHERAPY
105 Standardized protocols per anatomical area & clinical indication

<table>
<thead>
<tr>
<th>ANATOMIC AREA</th>
<th>PROTOCOL NAME ± CLINICAL INDICATION</th>
<th>MAIN CLINICAL INDICATION</th>
<th>MAIN DIAGNOSTIC TASK</th>
<th>SCANNING MODE/SLICE THICKNESS</th>
<th>EXAM DESCRIPTION</th>
<th>NUMBER OF SERIES</th>
<th>RPED</th>
<th>DRL p75 CTDIvol (mGy)</th>
<th>DRL p75 DLP per series (mGy.cm)</th>
<th>DRL p75 DLP per study (mGy.cm)</th>
<th>DRL p50 CTDIvol (mGy)</th>
<th>Standard Scan Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEST</td>
<td>General Chest</td>
<td>Staging, Tumor evaluation, Dyspnea, Ultrasound chest symptoms, First examination</td>
<td>Parenchyma, mediastinum, airways, mediastinal vessels</td>
<td>helical, recommended acquisition 2.5mm thickness + reconstruction 1.5 mm with bone filter (parenchymal)</td>
<td>First series, chest scan without contrast. Second series, with contrast.</td>
<td>max 2</td>
<td>17</td>
<td>10.0</td>
<td>300</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEST</td>
<td>Pulmonary Artery (Embolism)</td>
<td>Thrombus detection</td>
<td>Vessels, parenchyma</td>
<td>helical, recommended acquisition 0.625mm; + reconstruction 1.5 mm with bone filter (parenchymal)</td>
<td>First series, with contrast in inspiration low dose; CTA pulmonary arteries with contrast</td>
<td>max 2</td>
<td>336</td>
<td>7.5</td>
<td>225</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEST</td>
<td>Lung Parenchyma (3R)</td>
<td>Infections, nodules, Interstitial lung disease, bronchiectasis</td>
<td>Parenchyma, mediastinum, airways</td>
<td>reconstruction slice thickness is the same (1-1.5 mm). Reconstruction of 1.5 mm with bone filter (parenchymal) for the series without contrast. Mediastinum</td>
<td>Without contrast: One series in inspiratory apex OR two series in inspiratory, expiratory apex or prone position</td>
<td>max 2</td>
<td>280</td>
<td>7.5</td>
<td>225</td>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- standard number of series
- established Group DRLs
The KPIs

**STANDARDIZATION**
% of examinations performed with **STANDARD** (mapped) protocols

75%

**OPTIMIZATION**
% of examinations performed with standard protocol **WITHIN DRLs**

70%
Centralized Data Collection

# exams performed
78,686

Monthly volume

RPID Activity overview

<table>
<thead>
<tr>
<th>RPID</th>
<th>Activity</th>
<th>Volume</th>
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<tbody>
<tr>
<td>RPID17</td>
<td></td>
<td>4.22K</td>
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<tr>
<td>RPID213</td>
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<td>3.95K</td>
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<td>RPID248</td>
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<td>2.20K</td>
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<tr>
<td>RPID195</td>
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<td>4.02K</td>
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<tr>
<td>RPID1527</td>
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<td>1.66K</td>
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<tr>
<td>RPID372</td>
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<td>1.09K</td>
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<tr>
<td>RPID418</td>
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<td>1.44K</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>13.81K</td>
</tr>
</tbody>
</table>

Unmapped protocol
- RPID324
- RPID1057
Digital Dose Management

**Centralized data collection**
- Data analysis at Group, Country and Center level
- Ability for targeted actions per CT protocol, centre and CT technology
- Quicker optimization per volume and not per site
- Real time progress monitoring
- Compliance with EURATOM Directive transposition across Europe

**Quality & Safety**
- Real time detection of discrepancies in radiation exposure
- Real time monitoring of standardization of practice
Results

Standardization

% of examinations performed with STANDARD (mapped) protocols

75%

Optimization

% Exams < DRL by Modality

70%

% of examinations performed with standard protocol WITHIN DRLs

% Performed Standard

STD STUDY DESCRIPTION | STUDY DESCRIPTION | PROTOCOL

% exams below DRL | % not mapped | % performed standard

% exams < DRL

2,471 / 71%

% exams > DRL

% exams no reference
Discussion

• A Dose Management Program within a large-scale organization allows
  • practice unification
  • best practice sharing
  • optimized dose across countries

• Improvement initiatives
  • training on Dose Management
  • optimization of CT protocol parameters

• Knowledge, experience, and image quality feedback is shared between different countries to achieve optimum results to enhance patient safety