Optimization of the Patient CT Dose in Europe
Dr Virginia Tsapaki

Conflict of interest

• There is no conflict of interest

Topics that will be discussed:

How dose optimization is being implemented in Europe

• European legislation
• Industry initiatives
• European projects
• Various organizations initiatives
• Conclusions
The history of optimization in Europe goes back 20 years!

European Directive 29 1996

- Article 4: Optimization
- Article 8: Dose measurement is mandatory
- Article 9: Special attention to high dose exams such as CT
European Directive 59 2013

• Article 60

Equipment used for interventional radiology and **computed tomography** has the capacity to transfer the dose information to the record of the examination.

INDUSTRY INITIATIVES

- [http://www.cocir.org/](http://www.cocir.org/)

COCIR is the European Trade Association representing the medical imaging, radiotherapy, health ICT and electromedical industries.

- It is the “voice” of industry towards EU

- [http://www.cocir.org/](http://www.cocir.org/)
CT Manufacturer’s Voluntary Commitment Regarding CT Dose

- COCIR represents:
  ✓ General Electric
  ✓ Philips
  ✓ Siemens
  ✓ Toshiba

4 main commitments:

1. Characterization of CT Systems Standardized Benchmarking
2. Implementation of dose reduction measures in CT
3. Dose management and reporting
4. Provision of specific training curricula

2013 update

CT manufacturers have worked to provide an updated list of available technologies implemented for dose reduction on CT scanners, in line with Commitment 2 (Implementation of dose reduction measures in CT).
EUROPEAN PROJECTS

EUR 16262 EN, 1999

http://www.drs.dk/guidelines/ct/quality/

• Provides Reference doses for 6 types of exams
• Good imaging techniques

http://www.msct.eu/CT_Quality_Criteria.htm
MDCT dosimetry: Guidelines on radiation dose to the patient

<table>
<thead>
<tr>
<th>Region of body</th>
<th>Normalised effective dose, EDGL (mSv/mGy·cm)</th>
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<tbody>
<tr>
<td>Head</td>
<td>0.0021</td>
</tr>
<tr>
<td>Neck</td>
<td>0.0014 **</td>
</tr>
<tr>
<td>Chest</td>
<td>0.0191</td>
</tr>
<tr>
<td>Abdomen</td>
<td>0.0117</td>
</tr>
<tr>
<td>Pelvis</td>
<td>0.0171</td>
</tr>
<tr>
<td>Legs</td>
<td>0.0048 **</td>
</tr>
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</table>

** Conversion factor from previous document on CT quality criteria (CT edge group 2006).

** Calculated with CT Dose version 0.8.7, National Board of Health, National Institute of Radiation Protection, Switzerland.

European ALARA Network
Project started in 2009 and finished in 2012

http://www.eman-network.eu/

EMAN partners:

- Strålsäkerhetsmyndigheten (Swedish Radiation Safety Authority, SSM, Sweden), Coordinator
- European Federation of Medical Physicist (EFOMP)
- European Society of Radiology (ESR)
- European Federation of Radiographer Societies (EFRS)
- European Radiation Dosimetry Group (EURADOS)
- Bundesamt für Strahlenschutz (Federal Office of Radiation Protection, BfS, Germany)
- Centre d’étude sur l’Evaluation de la Protection dans le domaine Nucléaire (Nuclear Protection Evaluation Center, CEPN, France)
## Work package (WP 1) on Optimisation of Patient Exposures in CT-Procedures

- Mercè Ginjaume, EURADOS
- Jürgen Griebel, BfS
- Hans-Dieter Nagel, SASCRAD
- Elke Nekolla, BfS
- Dean Pekarovic, EFRS
- Mathias Prokop, ESR
- Virginia Tsapaki, EFOMP

### WP 1 CT Optimisation

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<td>J. Griebel (Lead), E. Nekolla</td>
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<td>2 CT risk / benefit estimation</td>
<td>J. Griebel (Lead), E. Nekolla</td>
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<td>3 CT dose reduction techniques, equipment</td>
<td>M. Prokop</td>
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<td>4 CT dose reduction techniques, protocols</td>
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<td>7 CT diagnostic reference levels</td>
<td>V. Tsapaki</td>
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<td>8 Training &amp; education</td>
<td>D. Pekarovic (Lead), V. Tsapaki, M. Prokop</td>
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### Key suggestions

- **Standard protocols** by manufacturers
- at various image quality levels, well below current DRLs
- **Common database format** for dose data
- with standardized protocol names to collect and compare dose
- **Core team**
- to focus training and provide clear responsibilities
- **Web-based forum and knowledge repository**
- to disseminate knowledge
- to share best practices and provide feedback
Partners

EFOMP & its professional & educational matters
Teaching hospitals
- Universities
  - Med. physics
  - Radiobiology
  - Physics
Screening organisations
(Industry) (Authorities)

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<td>Prof. K. Young &amp; A. McKenzie</td>
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<td>CT imaging and dose optimized with objective means</td>
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<td>Dr. R. Padovani &amp; Prof. E. Vano</td>
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<td>Radiation dose management of pregnant patients, pregnant staff and paediatric patients in diagnostic and interventional radiology (focus on CT)</td>
<td>Prof. J. Damilakis</td>
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<td>12</td>
<td>Personnel dosimetry, including techniques to communicate practical results to the users (RPE)</td>
<td>Dr. M. Borowski, prof. Fielich</td>
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Finished in July 2016
The project provided European DRLs for children and promoted their use so as to advance optimisation of radiation protection of paediatric patients, with a focus on CT, interventional procedures using fluoroscopy and digital radiographic imaging.

This 27-month project aimed at:
- Agreeing on a methodology for establishing and using DRLs for paediatric imaging
- Updating and extending the European DRLs to cover more procedures and a wider patient age/weight range based on current knowledge.

FREE registration

The aims of the Workshop were to:
- present and discuss the project’s results,
- submit the draft European Guidelines for comments and critical review by a larger audience and
- identify the needs for further action on DRLs and optimisation of radiation protection of paediatric patients.

The workshop aimed at key stakeholders in paediatric imaging.
BSS Transposition European Project
Evaluation of national actions regarding the transposition of Council Directive 2013/59/Euratom’s requirements in the medical sector

http://www.eurosafeimaging.org/bss-transposition

http://ec.europa.eu/programmes/horizon2020

OTHER EUROPEAN INITIATIVES FOR CT OPTIMIZATION
Medical Physicists together with the CT technologists are responsible for:

- Quality assurance of the CT scanners;
- Dose optimisation of the CT protocols;
- Patient dose measurements;
- Establishment of Diagnostic Reference Levels (DRLs);
- Investigation of events where a patient receives a dose which is higher than a defined level.
The European Alliance for Medical Radiation Protection Research (EURAMED) represents a consortium of associations involved in the application of ionising radiation in medicine:

- European Association of Nuclear Medicine (EANM)
- European Federation of Organisations for Medical Physics (EFOMP)
- European Federation of Radiographer Societies (EFRS)
- European Society of Radiology (ESR)
- European Society for Radiotherapy and Oncology (ESTRO)

with the goal of jointly improving medical care and its radiation protection issues through sustainable research efforts.


Optimization is one of the 5 top priority research topics

3.3. Optimisation of radiation exposure and harmonisation of practices
   3.3.1. Patient-tailored diagnosis and treatment including an expert system for optimisation
   3.3.2. Full exploitation and improvement of technology and techniques
   3.3.3. Clinical and dose structured reporting
   3.3.4. Protection of staff, patients, carers and general public

73 invited speakers
2 talks per day related to CT optimization

https://www.ecmp2016.org/site/page/program
Conclusions

• CT Optimization has a long tradition in Europe
• It is specifically mentioned in European legislations the last 20 years
• Millions of euros have been invested by EC on addressing the issue of optimization and radiation protection in CT. This will increase in the future within the Horizon 2020 research program.
• Collaboration and team work is strongly encouraged by various European organizations.
• European alliances are currently built up between various professionals for more efficient CT dose reduction.

THANK YOU

Hope to see you in Athens for ECMP 2016