EFOMP's point of view:

5 key issues for developing a RPCM

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II

(Non-legislative acts)

DIRECTIVES

COUNCIL DIRECTIVE 2013/59/EURATOM

of 5 December 2013

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

Member States shall ensure that depending on the medical radiological practice, the medical physics expert takes responsibility for dosimetry, including physical measurements for evaluation of the dose delivered to the patient and other individuals subject to medical exposure, give advice on medical radiological equipment, and contribute in particular to the following:

(a) optimisation of the radiation protection of patients and other individuals subjected to medical exposure, including the application and use of diagnostic reference levels;

(b) the definition and performance of quality assurance of the medical radiological equipment;

(c) acceptance testing of medical radiological equipment;

(d) the preparation of technical specifications for medical radiological equipment and installation design;

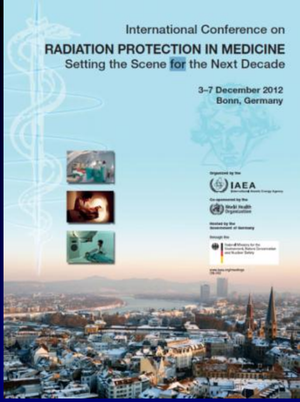
(e) the surveillance of the medical radiological installations;

(f) the analysis of events involving, or potentially involving, accidental or unintended medical exposures;

(g) the selection of equipment required to perform radiation protection measurements;

(h) the training of practitioners and other staff in relevant aspects of radiation protection;

Bonn Call for Action



1. Enhancing implementation of justification of procedures
2. Enhancing implementation of optimization of protection and safety
3. Strengthening manufacturers' contribution to radiation safety
4. Strengthening RP education and training of health professionals
5. Shaping & promoting a strategic research agenda for RP in medicine
6. Improving data collection on radiation exposures of patients and workers
7. Improving primary prevention of incidents and adverse events
8. Strengthening radiation safety culture in health care
9. Fostering an improved radiation benefit-risk-dialogue
10. Strengthening the implementation of safety requirements (BSS) globally

MPs' responsibilities are directly related to 'Bonn Call for Action' objectives

5 key issues for developing a RPCM

Justification

Optimization

Improving information for patients

Joining forces

Education and Training

EFOMP

5 Key issues for developing a RPCM

Justification

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Justification

We need:

- **clinical decision support systems for imaging referral guidelines**
- **dose data**

The ‘well hidden’ truths

Dose estimation in MDCT is based on $CTDI_{100}$

BUT

The ‘well hidden’ truths

$CTDI_{100}$ causes a systematic, substantial underestimation of the applied dose

The 'well hidden' truths

$$DLP = CTDI_{vol} \times (\text{scan length})$$

$$\text{Effective Dose} = DLP \times k$$

This method provides only a rough underestimated value of effective dose

The ‘well hidden’ truths
Effective dose vs. organ doses

Effective dose ‘hides’ differences in the doses delivered to various organs from CT examinations

CCTA: Dose with 256-slice scanning

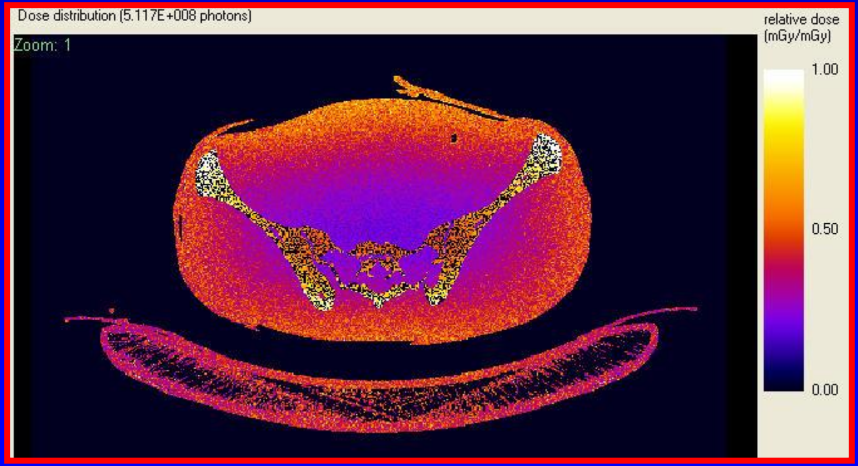
Effective Dose: < 2.0 mSv (Prospective mode)

Breast Dose: 14 mGy
Lung Dose: 9 mGy

Patient-based individualized dosimetry

MC simulations based on patient models created using

image data of patients who undergo CT studies



Radiation Protection Culture in Medicine

Unfortunately, there is lack of Medical Physicists in many European Countries.

Radiation Safety Culture in Medicine without Medical Physicists is like a child without a birth certificate

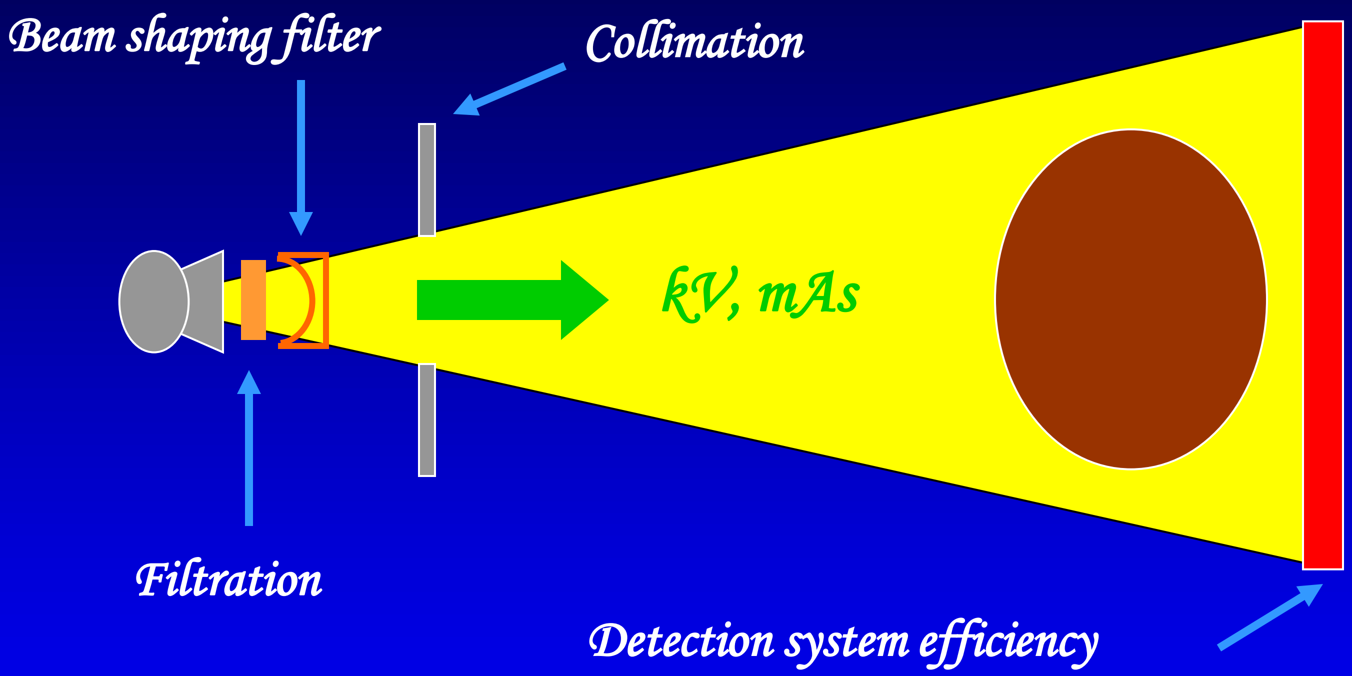
EFOMP suggests that the necessity for more MPs in health centres to ensure safe and accurate delivery of radiation dose should be included in the conclusions of the framework document about RPCM

5 Key issues for developing a RPCM

Justification

Optimization

Parameters that affect CT dose



Scanning length, Reconstruction slice width, Pitch,
Scanner geometry, Algorithms

5 key issues for developing a RPCM

Justification

Optimization

Improving information for patients

World Health Organization

EFOMP

Radiology

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Diagnostic CT Scans: Assessment of Patient, Physician, and Radiologist Awareness of Radiation Dose and Possible Risks[1]

Index terms:
Computed tomography (CT), radiation exposure
Radiations, exposure to patients and personnel

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Abbreviation:
ED = emergency department

[1] From the Department of Diagnostic Radiology (C.I.L., A.H.H., J.A.B., H.P.F.), Section of Emergency Medicine, Department of Surgery (E.P.M.), Department of Economics (H.P.F.), and School of Management (H.P.F.), Yale University, 333 Cedar St, TE-2, New Haven, CT 06520. From the 2002 RSNA scientific assembly. Received May 15, 2003; revision requested June 20; final revision received October 20; accepted November 19. Address correspondence to H.P.F. (e-mail: *howard.forman@yale.edu*).

PURPOSE: To determine the awareness level concerning radiation dose and possible risks associated with computed tomographic (CT) scans among patients, emergency department (ED) physicians, and radiologists.

MATERIALS AND METHODS: Adult patients seen in the ED of a U.S. academic medical center during a 2-week period with mild to moderate abdominopelvic or flank pain and who underwent CT were surveyed after acquisition of the CT scan. Patients were asked whether or not they were informed about the risks, benefits, and radiation dose of the CT scan and if they believed that the scan increased their lifetime cancer risk. Patients were also asked to estimate the radiation dose for the CT scan compared with that for one chest radiograph. ED physicians who requested CT scans and radiologists who reviewed the CT scans were surveyed with similar questions and an additional question regarding the number of years in practice. The χ^2 test of independence was used to compare the three respondent groups regarding perceived increased cancer risk from one abdominopelvic CT scan.

RESULTS: Seven percent (five of 76) of patients reported that they were told about risks and benefits of their CT scan, while 22% (10 of 45) of ED physicians reported that they had provided such information. Forty-seven percent (18 of 38) of radiologists believed that there was increased cancer risk, whereas only 9% (four of 45) of ED physicians and 3% (two of 76)

CONCLUSION: Patients are not given information about the risks, benefits, and radiation dose for a CT scan. Patients, ED physicians, and radiologists alike are unable to provide accurate estimates of CT doses regardless of their experience level.

Author contributions:
Guarantors of integrity of entire study, C.I.L., H.P.F.; study concepts and design, all authors; literature research, C.I.L.; clinical studies, C.I.L.; data acquisition, C.I.L., A.H.H., E.P.M.; data analysis/interpretation, all authors; manuscript preparation, definition of intellectual content, editing, revision/review, and final version approval, all authors

In hospitals in the United States, computed tomography (CT) accounts for just 13% of all diagnostic radiology procedures but is estimated to be responsible for more than 70% of the collective radiation dose delivered to patients (1,2). Recent high-speed multi–detector row CT technology creates more defined images in shorter times and has led to increased use of CT. With the introduction of new applications, the overall use of CT continues to grow inside and outside the hospital despite the fact that absorbed doses can be as much as 40% more than those associated with previous technology (3,4).

With growing use comes growing concern about risks associated with diagnostic CT. Effective doses with diagnostic CT have been shown to be similar to those received by Japanese survivors of the atomic bomb, who had a small but statistically significant increased risk of developing cancer as a result of the radiation (5). Findings in one heavily debated study (6) showed that the approximate number of deaths attributable to CT during 1 year in the United States was 700 for head examinations and 1,800 for abdominal

Lee C et al.
Radiology 231: 393-398, 2004

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Improving information for patients

Joining forces

World Health Organization

EFOMP

400 patients received radiation overdoses during perfusion CT of the brain

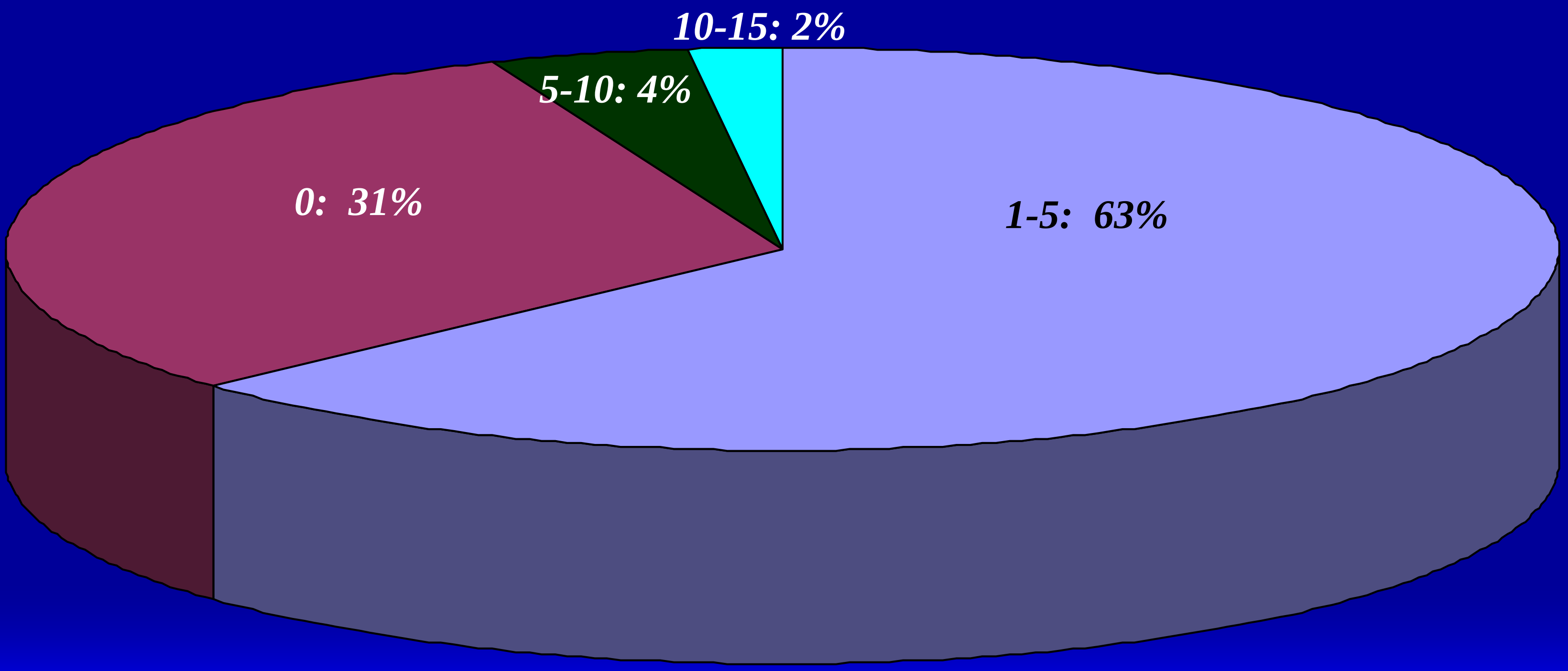
Food and Drug Administration (FDA) Website

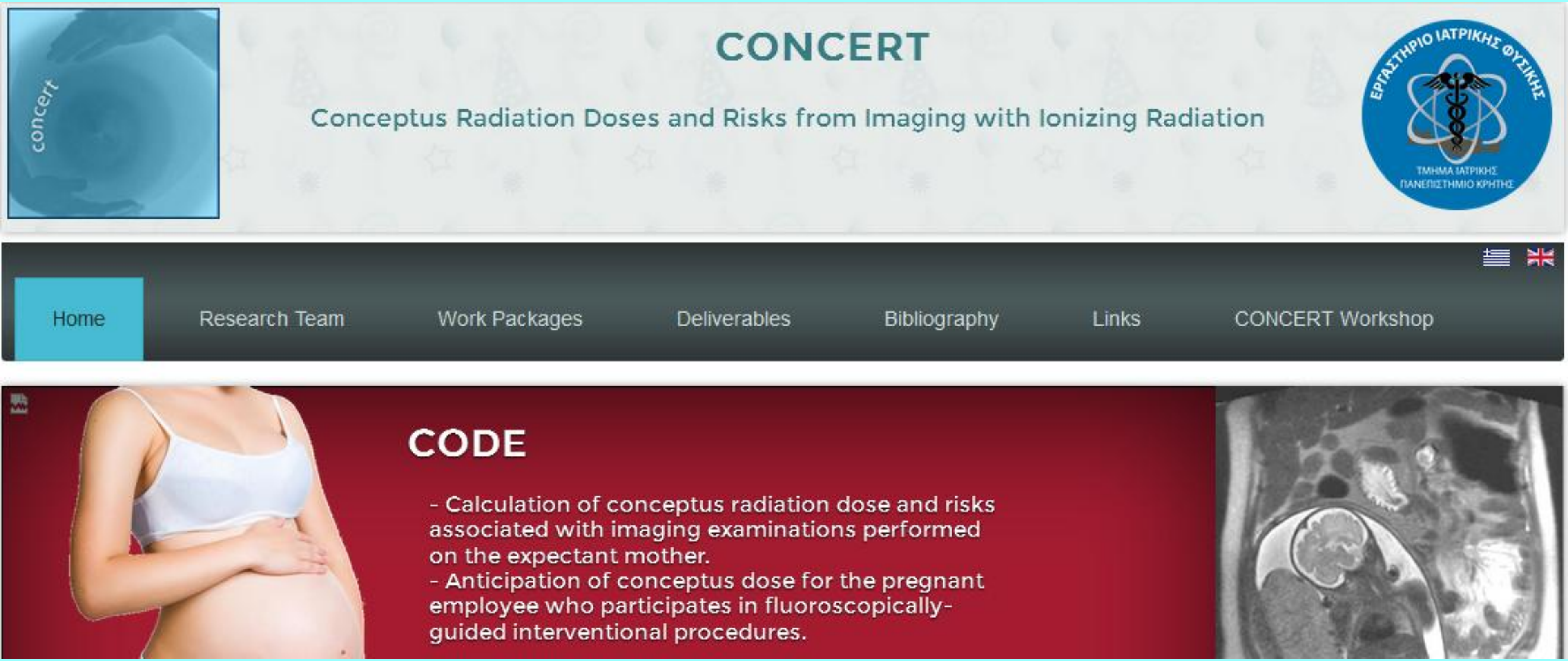
http ://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm185898 . htm

Survey on current practice patterns in imaging of pregnant patients

Question to Obstetricians:

How many pregnant patients exposed accidentally to diagnostic X-rays visited you during the last 12 months to ask advise about the biological effects of radiation to the conceptus?





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5 Key issues for developing a RPCM

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Education and Training

ORIGINAL CONTRIBUTION

Estimated Radiation Dose Associated With Cardiac CT Angiography

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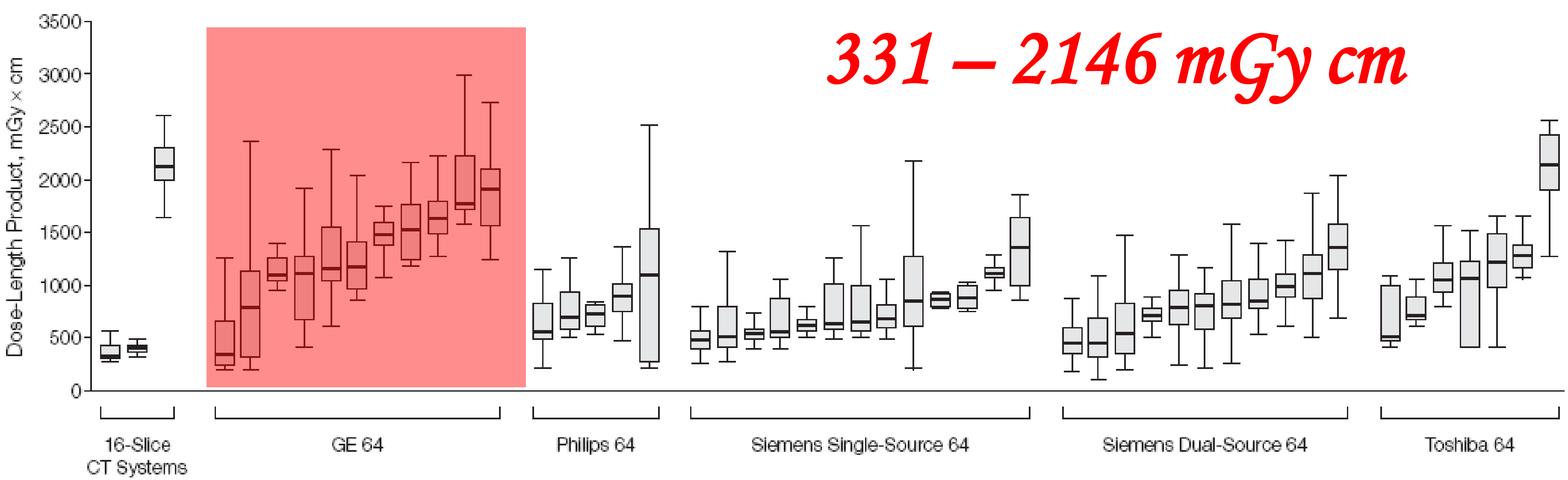
Context Cardiac computed tomography (CT) angiography (CCTA) has emerged as a useful diagnostic imaging modality in the assessment of coronary artery disease. However, the potential risks due to exposure to ionizing radiation associated with CCTA have raised concerns.

Objectives To estimate the radiation dose of CCTA in routine clinical practice as well as the association of currently available strategies with dose reduction and to identify the independent factors contributing to radiation dose.

‘An improved education of physicians and technicians performing CCTA on dose-saving strategies should be considered to keep the radiation as low as reasonably achievable.’

Figure 2. Site-Specific and System-Specific Radiation Dose of Cardiac Computed Tomography Angiographies for the 50 Participating Study Sites



with the magnitude of radiation exposure that is received during CCTA in daily practice and with the factors that contribute independently to radiation

For editorial comment see p 545.

dose of CCTA in daily practice, as quantified using the dose-length product (DLP), (2) the radiation dose for a coronary CT angiography in typical-sized patients undergoing 64-slice CCTA, (3) the association of currently available strat-

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Hausleiter J et al,
JAMA 301: 500-507, 2009

EFOMP's point of view

5 Key issues for establishing and maintaining RPCM	Comments
1. Justification	Use of non-ionizing radiation
2. Optimization	Reduction of radiation exposure
3. Improving information for patients	Better communication
4. Joining forces	Team work
5. Education and Training	Organizing training courses for the professionals