Dokumentation der Strahlendosis mit RIS und PACS
–
das IHE Profil REM
(Radiation Exposure Management)

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Überblick

1. Ausgangslage
2. Bisherige Möglichkeiten
3. Das Konzept von IHE REM
4. Erwartungen und Möglichkeiten
5. Zusammenfassung

Natürliche Strahlenexposition (in mSv)

Source or mode	*Annual average dose (worldwide)*	*Typical range of individual doses*	
Natural sources of exposure			
Inhalation (radon gas)	1.26	0.2-10	The dose is much higher in some dwellings
External terrestrial	0.48	0.3-1	The dose is higher in some locations
Ingestion	0.29	0.2-1	
Cosmic radiation	0.39	0.3-1	The dose increases with altitude
Total natural	**2.4**	**1-13**	**Sizeable population groups receive 10-20 millisieverts (mSv)**

Quelle:

United Nations

Report of the United Nations Scientific Committee on the Effects of Atomic Radiation

Fifty-sixth session (10-18 July 2008)

Artifizielle Strahlenexposition (in mSv)

- Medical diagnosis (not therapy) 0.6 0-several tens
  - The averages for different levels of health care range from 0.03 to 2.0 mSv; averages for some countries are higher than that due to natural sources; individual doses depend on specific examinations.
- Atmospheric nuclear testing 0.005
  - Some higher doses around test sites still occur. The average has fallen from a peak of 0.11 mSv in 1963.
- Occupational exposure 0.005 ~0-20
  - The average dose to all workers is 0.7 mSv. Most of the average dose and most high exposures are due to natural radiation (specifically radon in mines).
- Chernobyl accident 0.002*b*
  - In 1986, the average dose to more than 300,000 recovery workers was nearly 150 mSv; and more than 350,000 other individuals received doses greater than 10 mSv. The average in the northern hemisphere has decreased from a maximum of 0.04 mSv in 1986. Thyroid doses were much higher.
- Nuclear fuel cycle (public exposure) 0.0002*b*
  - Doses are up to 0.02 mSv for critical groups at 1 km from some nuclear reactor sites.
- **Total artificial 0.6**
  - **From essentially zero to several tens Individual doses depend primarily on medical treatment, occupational exposure and proximity to test or accident sites.**

Quelle:

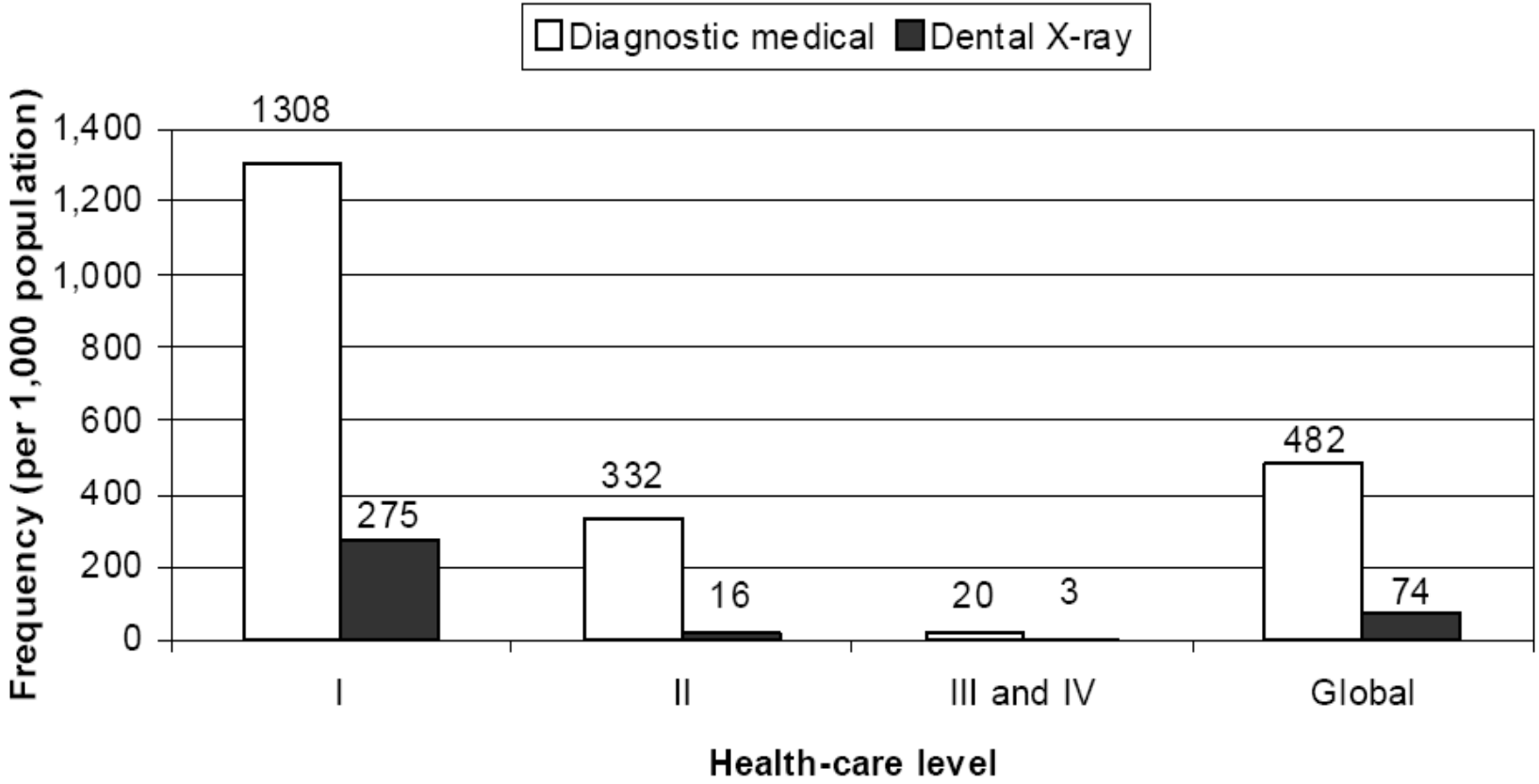
United Nations

Report of the United Nations Scientific Committee on the Effects of Atomic Radiation

Fifty-sixth session (10-18 July 2008)

Strahlenexposition - Entwicklungsstufe der Länder

Average annual frequency of diagnostic medical and dental X-ray examinations, by health-care level, 1997-2007



Quelle:

United Nations

Report of the United Nations Scientific Committee on the Effects of Atomic Radiation

Fifty-sixth session (10-18 July 2008)

Strahlenexposition Entwicklungsstufe der Länder

Trend in radiation exposure from diagnostic radiology

Year of Committee report in which survey data were analysed	*Number of examinations (millions)*	*Collective effective dose (man Sv)*	*Annual per caput dose (mSv)*
1988	1 380	1 800 000	0.35
1993	1 600	1 600 000	0.3
2000	1 910	2 300 000	0.4
2008	3 100	4 000 000	0.6

Quelle:

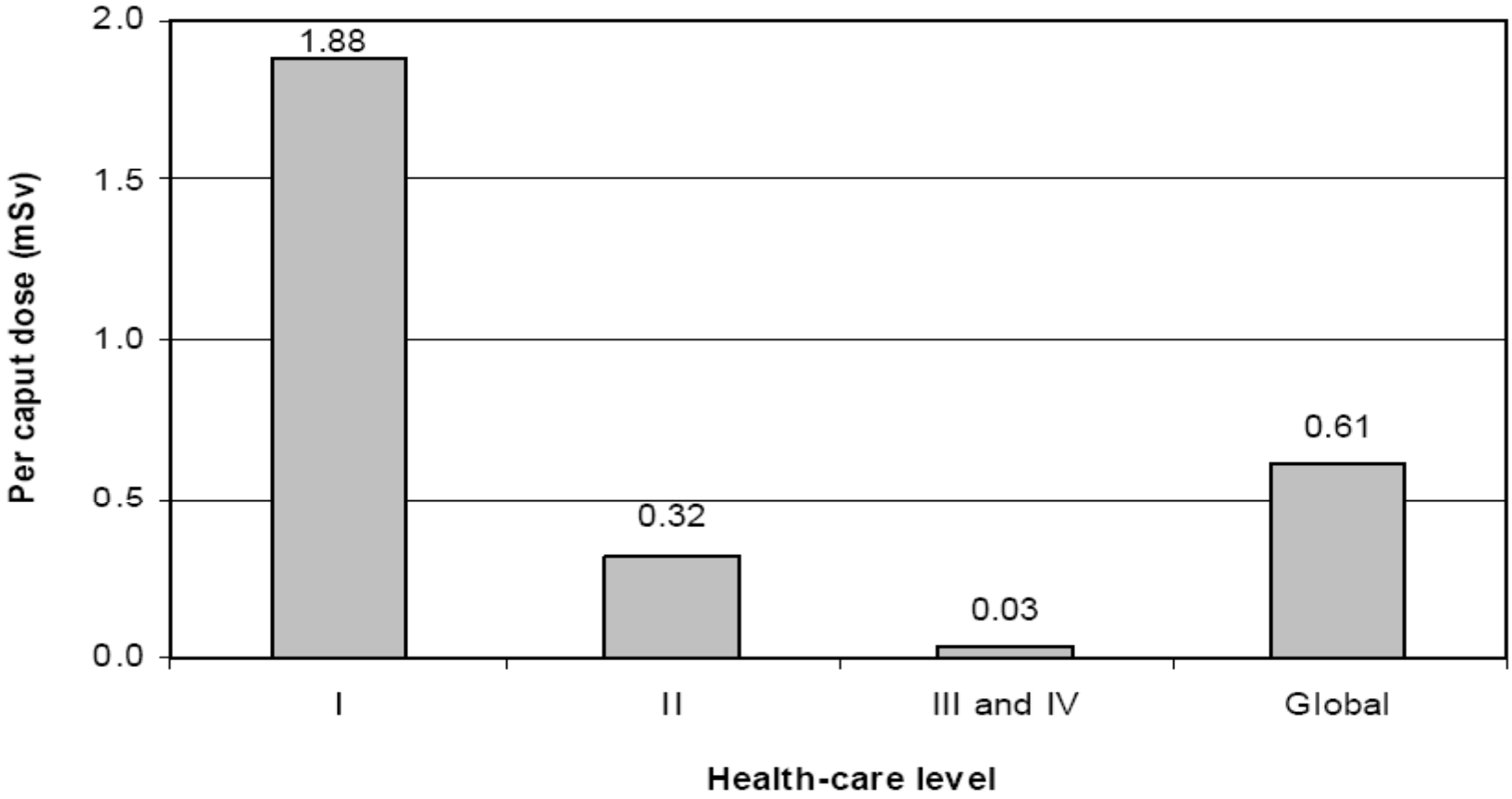
United Nations

Report of the United Nations Scientific Committee on the Effects of Atomic Radiation

Fifty-sixth session (10-18 July 2008)

Strahlenexposition - Entwicklungsstufe der Länder

Annual average per caput effective dose of ionizing radiation due to diagnostic medical and dental X-ray examinations, by health-care level, 1997-2007



Quelle:

United Nations

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Fifty-sixth session (10-18 July 2008)

Strahlenexposition – Einsatzgebiete und Länder

Health-care level	*Population (millions)*	*Source of exposure*			
		Diagnostic medical examinations (man Sv)	*Dental X-ray examinations (man Sv)*	*Nuclear medicine examinations (man Sv)*	*Total (man Sv)*
I	1 540	2 900 000	9 900	186 000	3 100 000
II	3 153	1 000 000	1 300	16 000	1 000 000
III	1 009	33 000	51	82	33 000
IV	744	24 000	38	..	24 000
World	6 446	4 000 000	11 000	202 000	4 200 000

Quelle:

United Nations

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Fifty-sixth session (10-18 July 2008)

Rahmenbedingungen

- Euratom Directive 97/43
- Radiation Protection N° 154
  - Dose DataMed
  - Annex: RADIATION PROTECTION N° 154
    http://ec.europa.eu/energy/nuclear/radiation_protection/publications_en.htm
    - Gewicht, Alter, Geschlecht
    - DFP, Anzahl der Aufnahmen und Bilder
    - CTDI und DLP
    - Angaben zu Phantom
- Diagnostische Referenzwerte
- Qualitätskontrolle
    - Erfassung nach verschiedenen Kriterien
      - Institution, Region, Verfahren, Beteiligte…

„Konventionelle“ Aufzeichnung

- „Röntgenbuch“
  - Manuelle Aufzeichnung, Aufwand, Fehleranfällig
- DICOM Header
- Modality Performed Procedure Step (MPPS)

Konventionelle Aufzeichnung

- DICOM Header
  - Nicht vollständig
  - Keine eindeutige Übersicht (z.B. verschiedene Rekonstruktionen im CT)

0018	0015	CS	CHEST	BodyPartExamined
0018	0060	DS	125	KVP
0018	1000	LO	99.00.006	DeviceSerialNumber
0018	1020	LO	Version 1.3.1	SoftwareVersions
0018	1030	LO	Thorax	ProtocolName
0018	1110	DS	2000	DistanceSourceToDetector
0018	1150	IS	2	ExposureTime
0018	1152	IS	1	Exposure
0018	115E	DS	0,658	ImageAreaDoseProduct
0018	1160	SH	0mmAl	FilterType
0018	1164	DS	0,143	ImagerPixelSpacing
0018	1166	CS	IN	Grid
0018	1170	IS	50	GeneratorPower
0018	1180	SH	Upper	CollimatorGridName
0018	1190	DS	2	FocalSpots
0018	1200	DA	08.01.2009	DateOfLastCalibration
0018	1201	TM	11:02:33	TimeOfLastCalibration
0018	1260	SH	Flat-Panel 43x43	PlateType
0018	1400	LO	P=halfField,a: CD=1.75 BD=0.35 G[1.50 8.00] C=0.80 N=0.50	AcquisitionDeviceProcessingDescription
0018	5020	LO	6000,16573,1248,2340,2621,9905,24534,30000,30000	ProcessingFunction
0018	5021	LO	Thorax_Mainz	PostprocessingFunction
0018	5101	CS	PA	ViewPosition
0018	6000	DS	400	Sensitivity

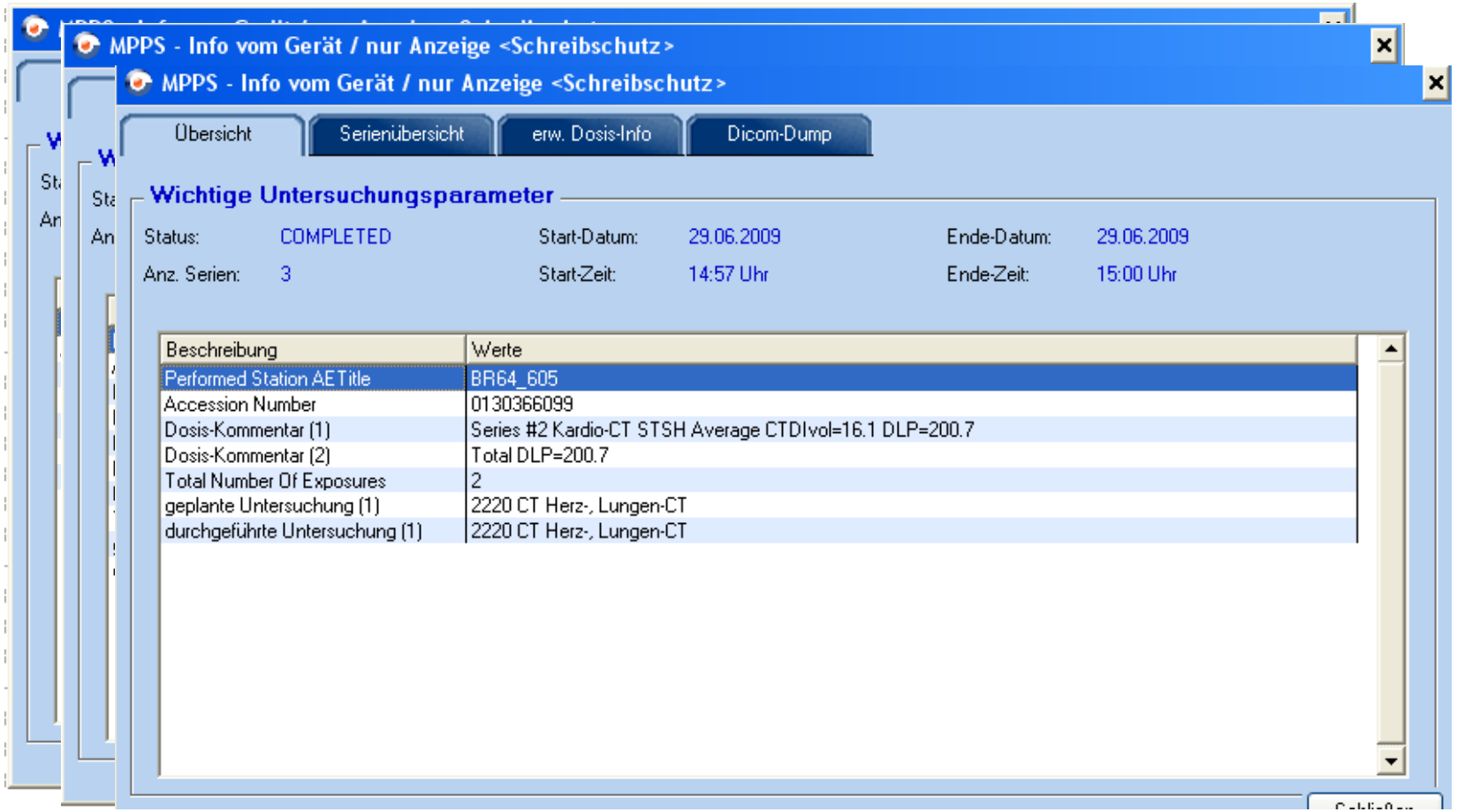
CR

0018	0022	CS	HELIX	ScanOptions
0018	0050	DS	3	SliceThickness
0018	0060	DS	120	KVP
0018	0088	DS	2	SpacingBetweenSlices
0018	0090	DS	500	DataCollectionDiameter
0018	1020	LO	2.3.0	SoftwareVersions
0018	1030	LO	Thorax nativ duenn/Thorax	ProtocolName
0018	1100	DS	397	ReconstructionDiameter
0018	1120	DS	0	GantryDetectorTilt
0018	1130	DS	159	TableHeight
0018	1140	CS	CW	RotationDirection
0018	1151	IS	144	XRayTubeCurrent
0018	1152	IS	100	Exposure
0018	1160	SH	B	FilterType
0018	1210	SH	B	ConvolutionKernel
0018	5100	CS	HFS	PatientPosition

CT

Konventionelle Aufzeichnung

- Modality Performed Procedure Step (MPPS)
  - Bisher die beste Lösung
  - Allerdings Übertragung als Nachricht, nicht als Datei (z.B. DICOM Objekt)
  - D.h. Modalität und RIS müssen MPPS unterstützen

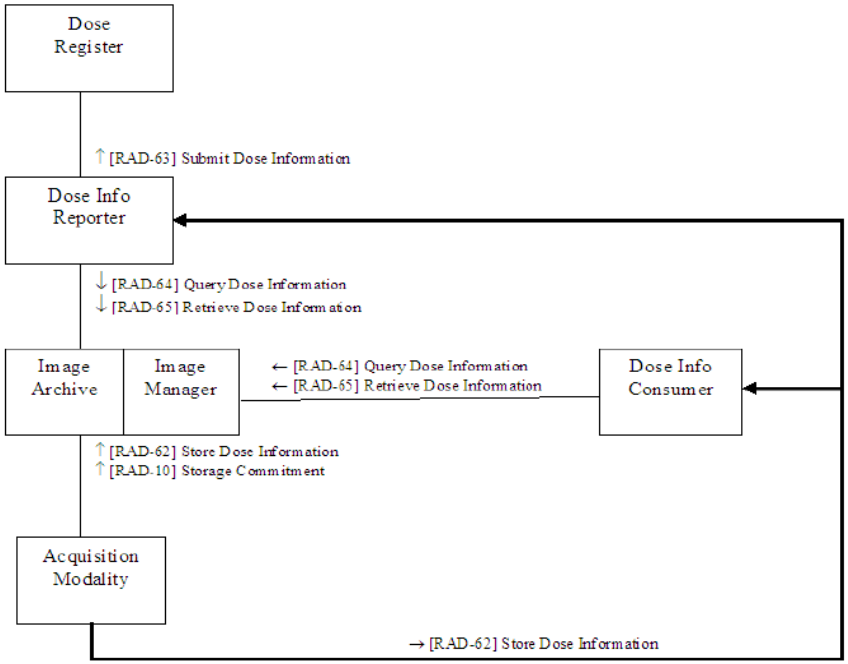


Die Zukunft

- IHE Radiation Exposure Management
  - Festlegung der zu dokumentierenden Informationen
  - Umsetzung mittels DICOM Structured Reporting
  - Abgestimmt mit IEC
- Supp 94 - Radiation Dose Report (2004)
- Supp 127 - CT Radiation Dose Reporting (Dose SR) (2007)

Radiation Exposure Management

- REM Akteure
  - Modalität mit Export von DOSE SR Objekten
    - Dose Acquisition Modality
      - Bsp. CT: kV, mA, Rotationszeit, Kollimation, Pitch, CTDIvol, DLP…
  - DICOM Archiv
    - Dose Image Manager / Archive
  - Applikation für Analysen
    - Dose Information Consumer
  - Abgestimmt mit IEC (Guidance 62B) und ACR Guidelines



Radiation Exposure Management

- Ermöglicht die “dose data pipeline”
  - Export von Modalität, Archivierung im PACS, Retrieve/Analyse an speziellen Workstations, Übergabe an Register
- CT Dose
  - DLP, CTDIvol, kVP, mA, sec
  - Effective Dose [Optional]
    (Reference estimation method)
- Projection X-Ray Dose
  - DAP, Dose@RP, kVP, mA, sec
  - Fluoro Dose, Fluoro Time
- Mammography Dose
  - AGD, Entrance Exposure @ RP, kVP, mA, sec
  - Compression, Half Value Layer

Radiation Exposure Management

- Empfehlung
  - Hersteller nach Verfügbarkeit fragen
  - Bei aktuellen und zukünftigen Beschaffungsmaßnahmen als Bestandteil (ggf. kostenneutrale Nachlieferung nach Verfügbarkeit) einfordern
- mehr: www.ihe.-net