



**Grouping of examinations and methods of re-  
grouping of categories**  
**Introduction on categories of X-ray examinations**  
**in RP 154**

Abbas Aroua and Ferid Shannoun

**Training course:**  
**Population doses for countries without national**  
**surveys**

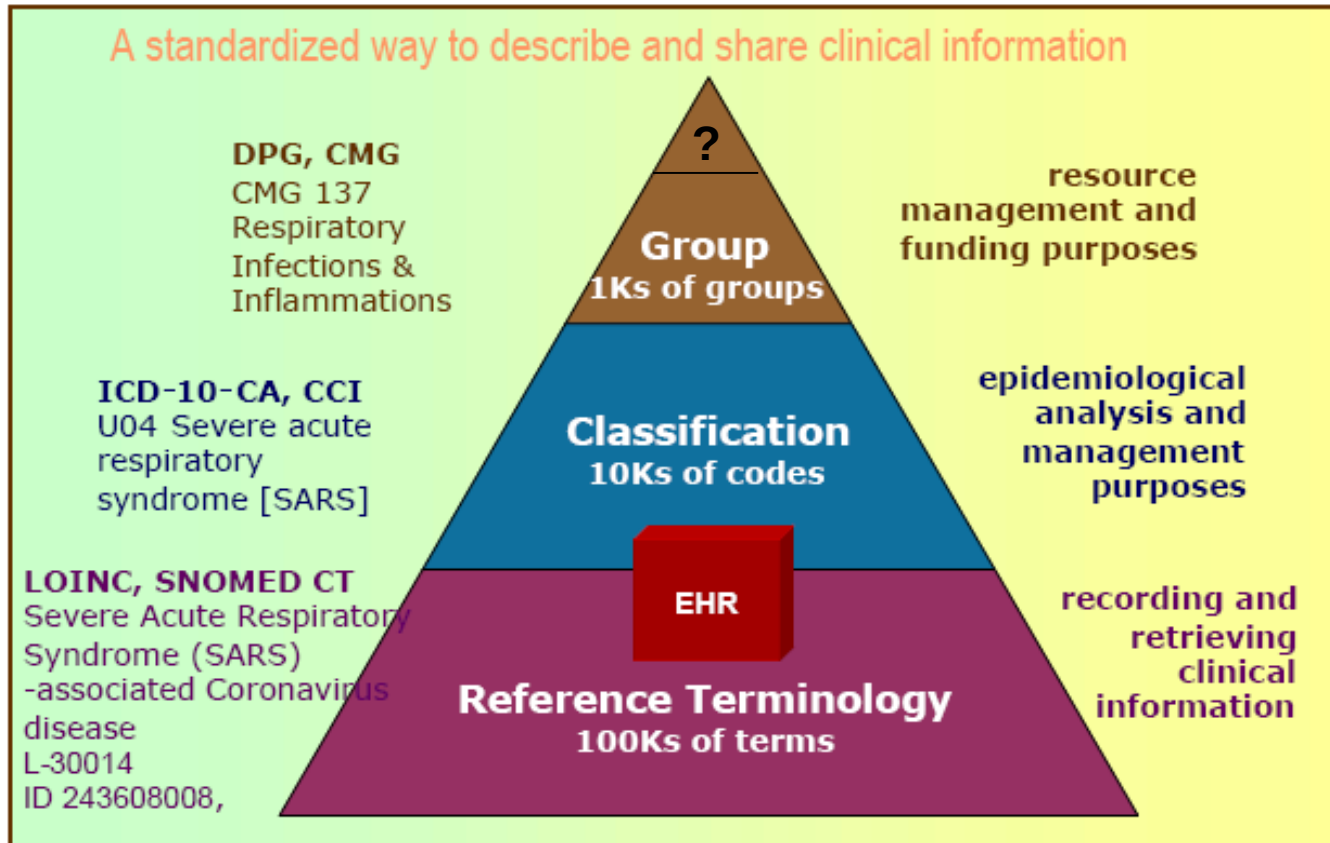


# **DOSE DATAMED REPORT (RP 154) GUIDANCE ON ESTIMATING POPULATION DOSES FROM MEDICAL RADIOLOGY**

- 1. Introduction**
- 2. Purposes for making population dose estimates for medical x-rays and the dose quantities used**
- 3. Guidance on assessing frequency of x-ray examinations**
  - 3.1 How to categorise examinations**
  - 3.2 X-ray examination frequency survey methods**
  - 3.3 Sources of uncertainty in frequency estimates and how to reduce them**
- 4. Guidance on assessing patient doses**
  - 4.1 Patient dose survey methods**
  - 4.2 How to convert measured doses into organ and effective doses**
  - 4.3 Sources of uncertainty in patient doses and how to reduce them**
- 5. Guidance on assessing age/sex distributions of x-ray patients**
- 6. Guidance on presenting the results of population dose estimates**
- 7. Use of electronic information stored in modern medical imaging equipment and RIS**



## Reference Terminologies, Classification Systems and Groups



Types of clinical information terminologies



## What's an X-ray examination?

- § An x-ray examination may consist of a single radiograph or several radiographs
- § With or without the use of fluoroscopy
- § One or a series of CT scans
- § Images may be taken with and/or without contrast media to enhance soft tissues
- § Several organs or body parts might be involved in one examination depending on the clinical indication



## What's an X-ray examination?

“An x-ray examination or interventional procedure is defined as one or a series of X-ray exposures of one anatomical region/organ/organ system, using a single imaging modality (i.e. radiography/fluoroscopy or CT), needed to answer a specific diagnostic problem or clinical question, during one visit to the radiology department, hospital or clinic”

### ***Examples:***

- ***An examination of the GI tract with several radiographs combined with***



## **Difficulties encountered in selecting X-ray examination types**

"The first problem in assessing the frequency of x-ray examinations is to decide how much detail is required in the differentiation and categorisation of x-ray examinations to be able to make a reliable estimate of the total collective dose and the major contributors to it."

RADIATION PROTECTION N° 154

### *Examples:*

- **Different Systems: Codes or common names of exams (public and private)**
- **Various local categorations (hospital specific)**
- **Different names for the same X-ray procedure**
- **Different protocols for performing the same examination (uncertainty on dose)**



## **Difficulties encountered in selecting X-ray examination types**

### **Challenge: to find a balance between:**

- a) very fine categorisation : accuracy but work load
- b) very broad categorisation : practical but approx

### **Main data sources for frequency:**

- Information Systems in Hospitals (RIS/HIS)
- National health insurance databases

### **Classification approach of RP 154:**

- Imaging or interventional procedure modality
- Body or organs/tissues being imaged



## Example for a hospital in Luxembourg (Number of CT Examinations)

IMAGERIE MEDICALE **Health Insurance**

Examens SCANNER 2004

	2004	Taux
NEURO	5877	48.8%
THO-ABD-PELV	3719	30.9%
OSTEO	911	7.6%
ANGIO	765	6.4%
INTERV	593	4.9%
DENTA	109	0.9%
PARTIE MOLLES	57	0.5%
<b>Total</b>	<b>12031</b>	<b>100%</b>

**RIS/HIS > 50 different CT exams**

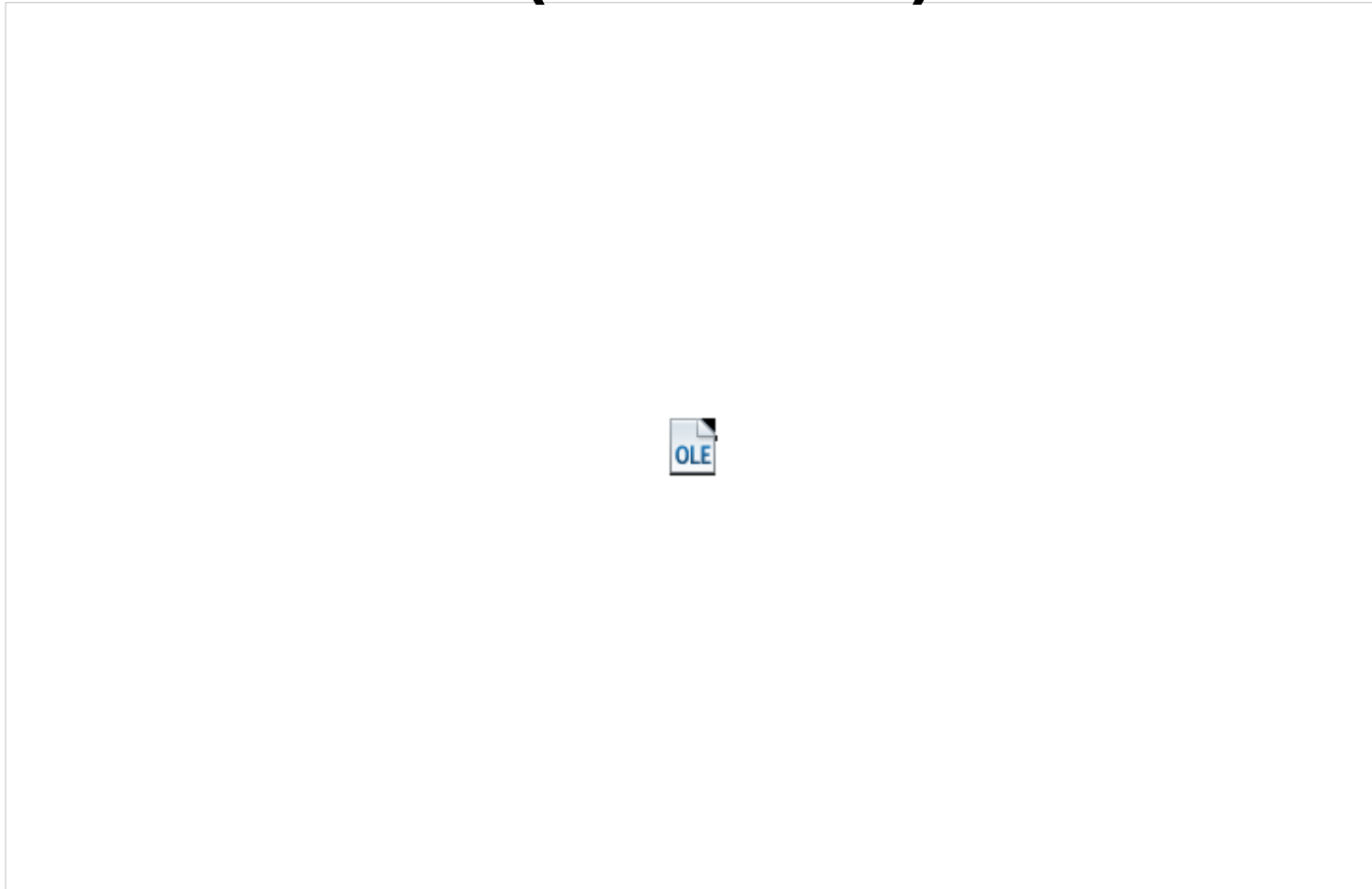
CT Abdomen	1021	8.49%	THO-ABD-PELV
CT Abdomen Pelvis	1450	12.05%	THO-ABD-PELV
CT AbdoPelvis+Crane	12	0.10%	THO-ABD-PELV
CT Pelvimetrie	23	0.19%	THO-ABD-PELV
CT Pelvis	49	0.41%	THO-ABD-PELV
CT Th_Abdo_Pelv+Crâne	63	0.52%	THO-ABD-PELV
CT Thorax	702	5.83%	THO-ABD-PELV
CT Thorax Abdomen	169	1.40%	THO-ABD-PELV
CT Thorax AbdoPelvis	191	1.59%	THO-ABD-PELV
CT Thorax Cou	19	0.16%	THO-ABD-PELV
CT Thorax Crâne	20	0.17%	THO-ABD-PELV

Examen	2004	Taux	Classement
CT ArthroCheville	5	0.04%	OSTEO
CT ArthroCoude	5	0.04%	OSTEO
CT ArthroEpaule	114	0.95%	OSTEO
CT ArthroGenou	115	0.96%	OSTEO
CT ArthroHanche	1	0.01%	OSTEO
CT ArthroPoignet	38	0.32%	OSTEO
CT Articulation Temporo-Mandibulaire	10	0.08%	OSTEO
CT Bassin	60	0.50%	OSTEO
CT Cheville	57	0.47%	OSTEO
CT Coude	38	0.32%	OSTEO
CT Epaule	54	0.45%	OSTEO
CT Fémur	4	0.03%	OSTEO
CT Genou	93	0.77%	OSTEO
CT Hanche	70	0.58%	OSTEO
CT Humérus Gauche	3	0.02%	OSTEO
CT Massif facial	60	0.50%	OSTEO
CT Pied Droit	61	0.51%	OSTEO
CT Poignet	110	0.91%	OSTEO
CT Tibia	13	0.11%	OSTEO
CT Angio Membre supérieur	4	0.03%	ANGIO
CT Ao+Rénales	69	0.57%	ANGIO
CT Aorte Abdominale	44	0.37%	ANGIO
CT Aorte Thoracique	28	0.23%	ANGIO
CT AoThoracoAbdominale	12	0.10%	ANGIO
CT Carotides	125	1.04%	ANGIO
CT Embolie Pulmonaire	308	2.56%	ANGIO
CT Membres Inférieurs	172	1.43%	ANGIO
CT Membres Inferieurs Veineux	3	0.02%	ANGIO
CT CAI	8	0.07%	NEURO
CT Crâne	2248	18.69%	NEURO
CT Rochers	104	0.86%	NEURO
CT Sinus	817	6.79%	NEURO
CT Rachis Cervical	798	6.63%	NEURO
CT Rachis Dorsal	83	0.69%	NEURO
CT Rachis Lombaire	1819	15.12%	NEURO





# **Categorisations used by ten European countries (1995-2002)**



**RADIATION PROTECTION N° 154, ANNEX 1**



**Example : 1998 Swiss survey**  
***257 types of X-ray examinations covering 9***  
***radiological modalities***

Modality	Number
Radiography	54
Dental radiology	33
Fluoroscopy	33
Diagnostic interventional radiology	35
Therapeutic interventional radiology	43
Computed tomography	47
Mammography	04
Bone densitometry	06
Conventional tomography	



## List of examinations considered in the Swiss 1998 Survey (Computed tomography)

### Head and neck

Skull

Face

Temporal-mandibular joint

Orbits

Pituitary gland

Sinus

Internal auditory meatus

Nasal cavity

Petrosal bone

Sella turcica

Temporal bone

Mouth

Dental

Neck

Larynx

Pharynx

Cervical spine



# How to categorize examinations?

## *Plain film radiography*

10 regions: head, neck, chest/thorax, abdomen, pelvis, limbs, trunk, head&trunk, teeth&gums, breasts

27 broader categories: bone and soft tissue

About 70 specific examination procedures

## *Radiography/fluoroscopy*

7 regions: GI tract, biliary tract, uro-genital tract, spinal cord, joints, angiography, lymphangiography

17 broader categories of examinations

About 58 specific examination procedures

## *CT Examinations*

10 regions: head, neck, chest, abdomen, pelvis, combined, limbs

18 broader categories of CT examinations

53 specific examination procedures

## *Interventional Radiology*

5 regions: head, neck, chest, abdomen, pelvis, limbs

10 categories of examinations

40 specific interventional procedures



# Example of categories and types of examinations recommended (Plain film radiography ) RADIATION PROTECTION N° 154

Region of body	Specific exam types	DOSE DATAMED exam categories	UNSCEAR 2000 categories
Chest/Thorax	Thoracic spine	Thoracic spine	Thoracic spine
	Shoulder blades/ scapulae Collar bone(s) / clavicle(s) Acromio-clavicular joint Sterno-clavicular joint Manubrio-sternal joint Sternum	Shoulder girdle	
	Ribs	Ribs	Chest (radiography)
	Lung  Thoracic inlet  Bronchography	Chest/thorax/lung	Chest (photo-fluoro.) Chest (fluoroscopy)
Abdomen	Lumbar spine	Lumbar spine	Lumbar spine
	Lumbo-sacral joint	Lumbo-sacral joint only	
	Abdomen (plain film, patient supine or erect)	Abdomen	Abdomen
Pelvis	Pelvic bones - Ilium/ischium/pubis - Sacrum - Sacro-iliac joint - Coccyx	Pelvic bone	Pelvis & hips
	Pelvimetry (obstetric)		
	1 or both hips	Hips	
	Pelvis (soft tissue)	Pelvis (soft tissue)	
Breast	Symptomatic: - 1 or 2 views of 1 or both breasts Screening: - 1 or 2 views of both breasts	Mammography	Mammography (screening or clinical diagnosis)



## Categories and types of examinations recommended by the Dose Data Med I

§ **225** specific types of examination or procedure covering 4 radiological modalities and based on regions:

- Plain film radiography (medical and dental)
- Radiography/fluoroscopy
- Computed tomography
- Interventional Radiology (diag. and therap.)

§ **70** broad categories of examinations based on regions

§ **20** examinations with the highest contribution to the collective dose



## Appendix 1: Detailed descriptions of 'Top 20 Exams'

Exam Type	Specific exams included in 'Exam type'	Common Technique	Common indications
1. Chest/lung	Lungs & ribs Thoracic inlet	PA radiograph  LAT radiograph	Adult pneumonia, chest pain, pericarditis, pleural effusion, pneumothorax.  A LAT is taken after PA <b>only if</b> necessary to locate a pulmonary nodule or a hilar projection shadow more precisely
2. Cervical spine	Cervical spine	AP & LAT/Oblique radiographs	Trauma, cervical pain/neuralgia
3. Thoracic spine	Thoracic spine	AP & LAT radiographs	Trauma, interscapular back pain
4. Lumbar spine	Lumbar spine Lumbo-sacral joint Sacro-iliac joints Sacrum & coccyx	AP & LAT radiographs	Trauma, lumbar pain, sciatica, cauda equina syndrome
5. Mammography	Symptomatic & Screening	Medio-lateral oblique &/or Cranio-caudal radiographs on one or both breasts	Breast cancer screening, breast cancer symptomatic patients
6. Abdomen	Abdomen (plain film)	AP radiograph	Acute abdominal pain, monitoring occlusive syndromes
7. Pelvis & hip	Pelvis (one or both hips)	AP radiograph or AP & LAT radiographs	Trauma, rheumatology, dysplasia

8. Ba meal	Ba meal (stomach & duodenum)	2-3 minutes fluoroscopy 5-20 images	Preoperative analysis for certain stomach lesions and for postoperative monitoring after gastric and oesophageal surgery
9. Ba enema	Ba enema (colon)	~2 minutes fluoroscopy 5-10 images	Inflammation, suspected tumour, control after surgery and for occlusive syndromes
10. Ba follow	Ba follow (small intestine) Small bowel enema	~5 minutes fluoroscopy 5-20 images	Small bowel disease (e.g. Crohn's disease, malabsorption syndromes)
11. IVU (Intravenous Urography)	IVU (kidneys, ureter and bladder)	Several AP radiographs after IV injection of iodine contrast medium	Haematuria, renal colic, infection of urinary organs, dilation of excretory organs, unexplained backache, urological tumour
12. Cardiac angiography	Coronary angiography Left or right ventriculography	~5 minutes fluoroscopy Several hundred images	Atheromatous arterial disease or coronary anomaly, spastic angina. Systolic or diastolic dysfunction. Mitral, tricuspid, aortic or pulmonary valve dysfunction.

Exam Type	Specific exams included in 'Exam type'	Common Technique	Examples for indications
13. CT head	Head, brain, facial bones	With or without contrast	Brain lesion, acute stroke. Chronic rhinosinusitis, nasal obstruction, nasosinusitis polyposis, anosmia. Facial trauma. Chronic inflammation of middle ear, petrosal bone trauma. Congenital malformations.
14. CT neck	Soft tissue in neck, cervical spine	No contrast	Trauma, cervical pain/neuralgia, medullary compression syndrome, extra- or intra-spinal tumors
15. CT chest	Chest/thorax	With or without contrast Std or High resolution	Mediastinal/pleural/pulmonary pathology. Diffuse infiltrative lung disease, bronchial diseases, lung cancer
16. CT spine	CT of lumbosacral spine	With or without contrast	Trauma, lumbar pain, lumboradiculalgia, sciatica, cauda equina syndrome
17. CT abdomen	Abdominal organs	With or without contrast	Cancer diagnosis and staging, infectious lesions, inflammatory diseases, major trauma. Acute abdominal pain. Suspected haemorrhage. Chronic hepatic illness, liver metastases or suspected obstruction of hepatic vessels.
18. CT pelvis	Pelvic bone &/or organs	With or without contrast	Cancer diagnosis and staging, location of stones/lesions/tumours resulting in obstruction of urinary channels. Suspected extrinsic compression or malformation of the urinary channels. Pelvimetry
19. CT trunk	CT of chest, abdomen & pelvis. CT of thoracic/ abdominal aorta	With or without contrast  With contrast	Metastases from unknown primary tumour, lymphoma, trauma.  Thoracic/abdominal aorta disease: aneurysm, occlusion, dissection, inflammation, embolism, malformation.

Exam Type	Specific exams included in 'Exam Type'	Common Technique	Examples for indications
20. Coronary angioplasty (PTCA)	PTCA	Catheter access via femoral or brachial artery, balloon inflation at constriction, stenting may be performed	Angina or painless myocardial ischemia in relation to one or several coronary lesions. Acute myocardial infarction.



# Summary

RP 154 is a very useful tool for classification of radiological exams but is not a new standard

Involvement of societies of radiology, medical physics and radiographers is important as well as representatives from health insurances, regulatory bodies, etc.

Dose Data Med II uses all RP 154 classifications (225/70/20)

TOP 20 exams give a good orientation but are only the minimum and limit the trend evaluation

Combination of the classification methods can improve the quality (e.g. Computed tomography)

Uncertainties in the survey method

- How to count the examinations/procedures

- Scaling of frequencies from small sample to whole country

- Dosimetric methods and sample of hospitals

---





***Thank you for your attention!***

