

# Population doses from x-ray and nuclear medicine procedures in Nordic countries

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Nordic group on medical applications

DoseDatamed 2 collected data  
from 36 European countries



Published in EU RP 180  
**Medical Radiation Exposure of  
the European Population**

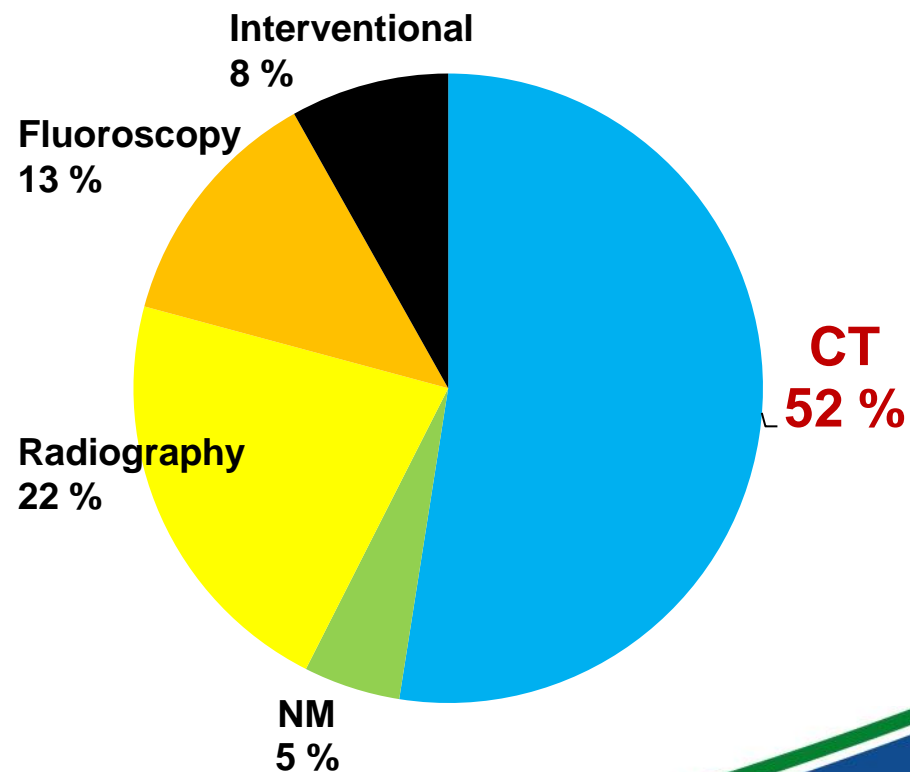
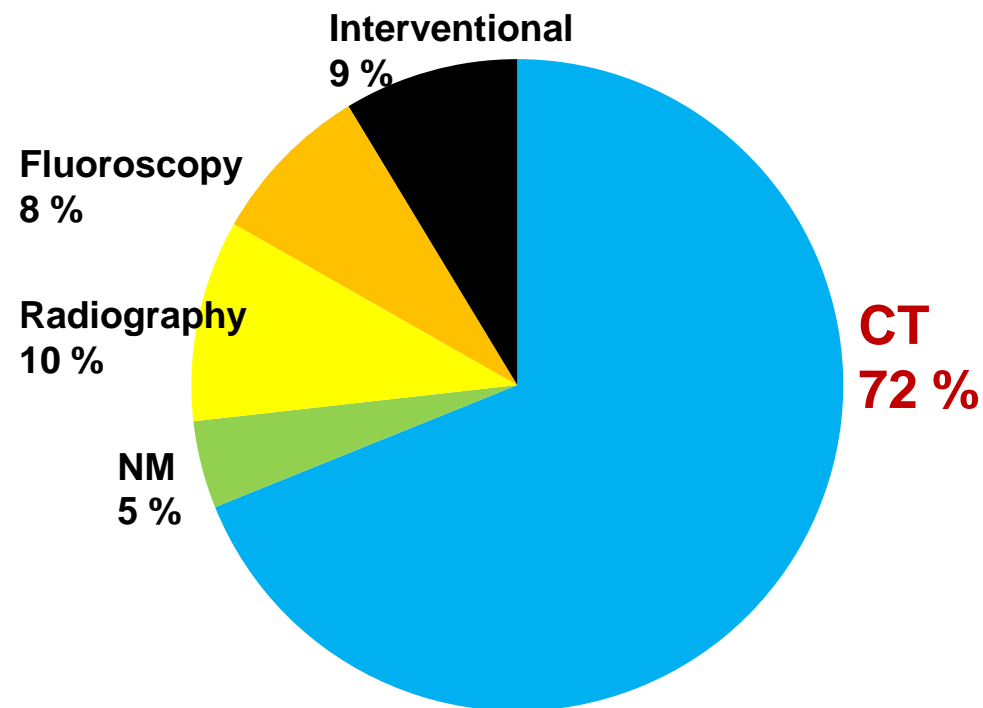
Funded by the



# RELATIVE CONTRIBUTION TO THE POPULATION DOSE IN NORDIC COUNTRIES AND IN EUROPE

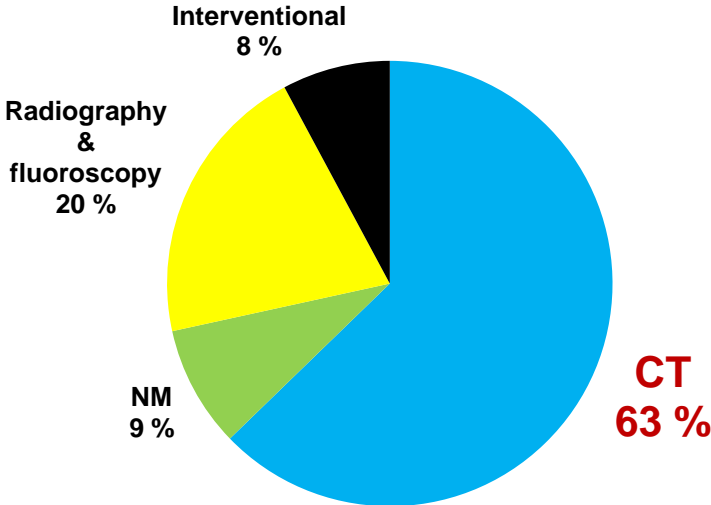
## Nordic countries

## Europe

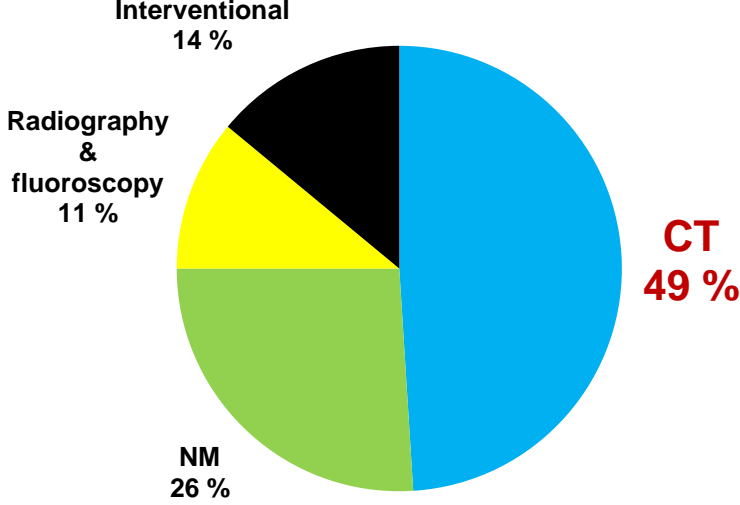


# RELATIVE CONTRIBUTION TO THE POPULATION DOSE IN AUSTRALIA AND USA

## Australia



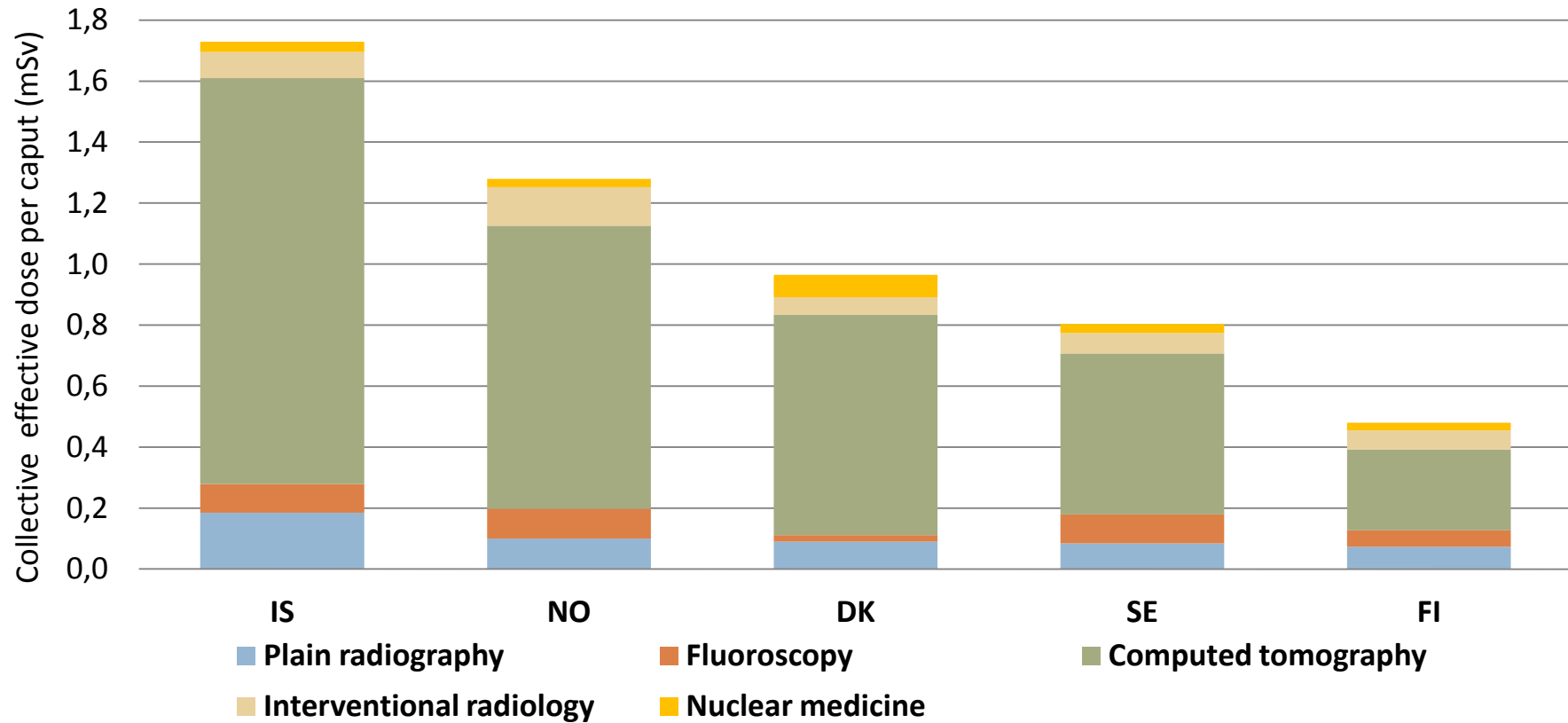
## USA



Hayton et al. Radiation Protection Dosimetry (2013), pp. 1–6

NCRP Report Number 160

## COLLECTIVE EFFECTIVE DOSES



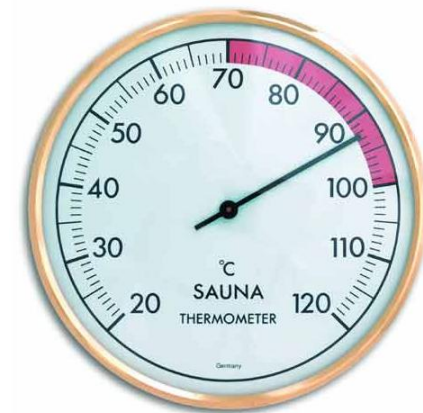
## WHAT DOES POPULATION DOSE INDICATE?

HIGHER collective effective dose may indicate

- higher frequencies of procedures
  - unjustified procedures?
- more use of high dose procedures
- unoptimized procedures

LOWER collective effective dose may indicate

- lower frequencies of procedures
- not adequate availability of equipment according to good medical practice
- optimized procedures



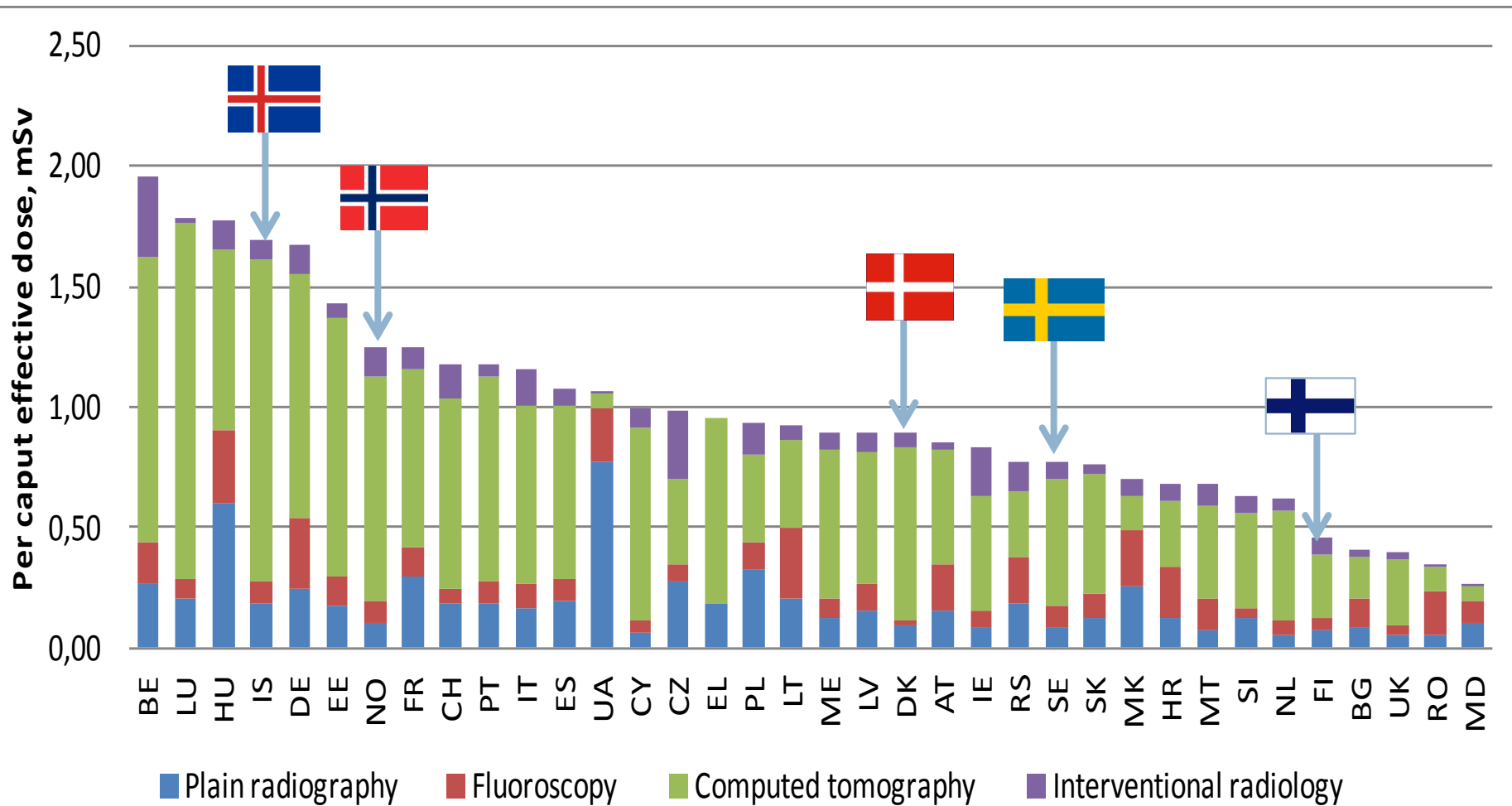
## DOSES FROM X-RAY AND NM PROCEDURES

All 36 European countries included in this survey:  
636 100 manSv, resulting in a mean effective dose of  
**1,1 mSv per caput.**

EU-countries and EFTA countries (Norway, Iceland and Switzerland): 578  
200 manSv, resulting in a mean effective dose of **1,1 mSv per caput.**

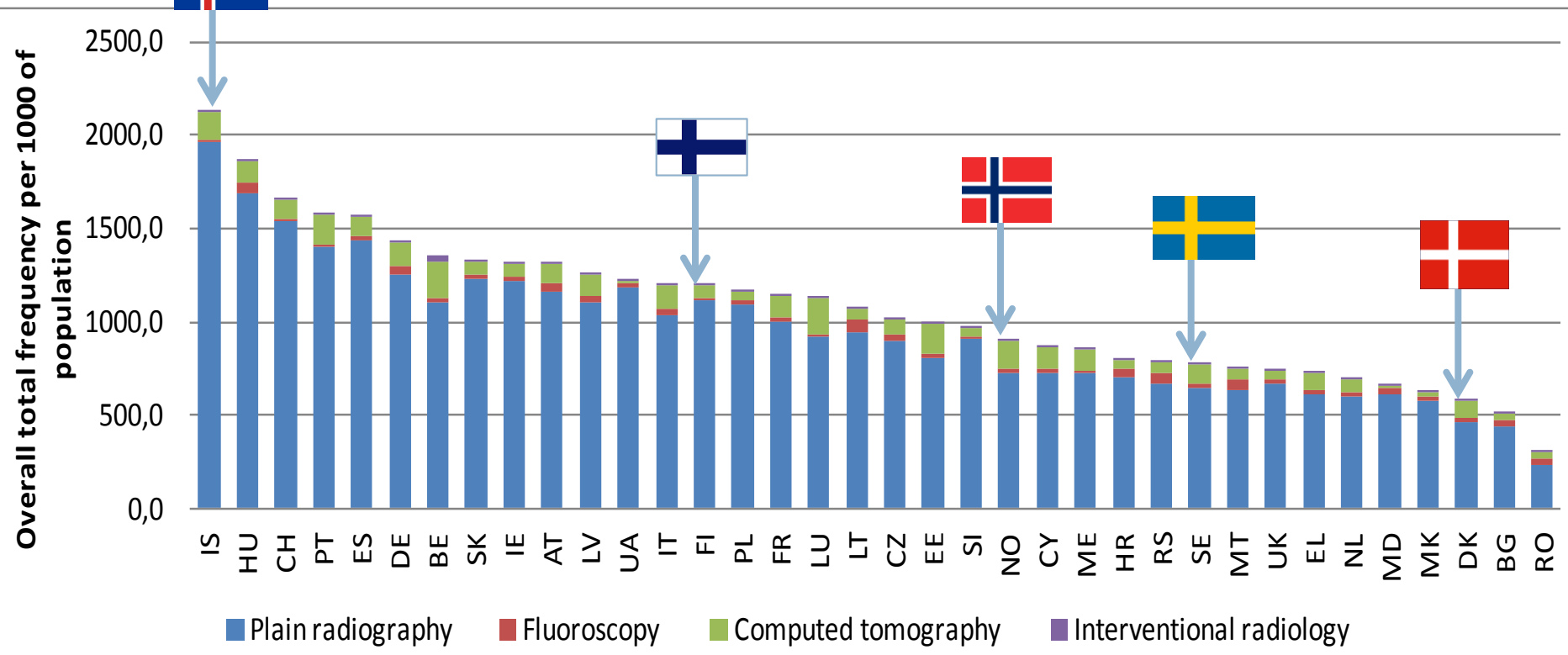
Nordic countries: 21 924 manSv, resulting in a  
mean effective dose of **0,87 mSv per caput**

## X-RAY: COLLECTIVE EFFECTIVE DOSES per caput



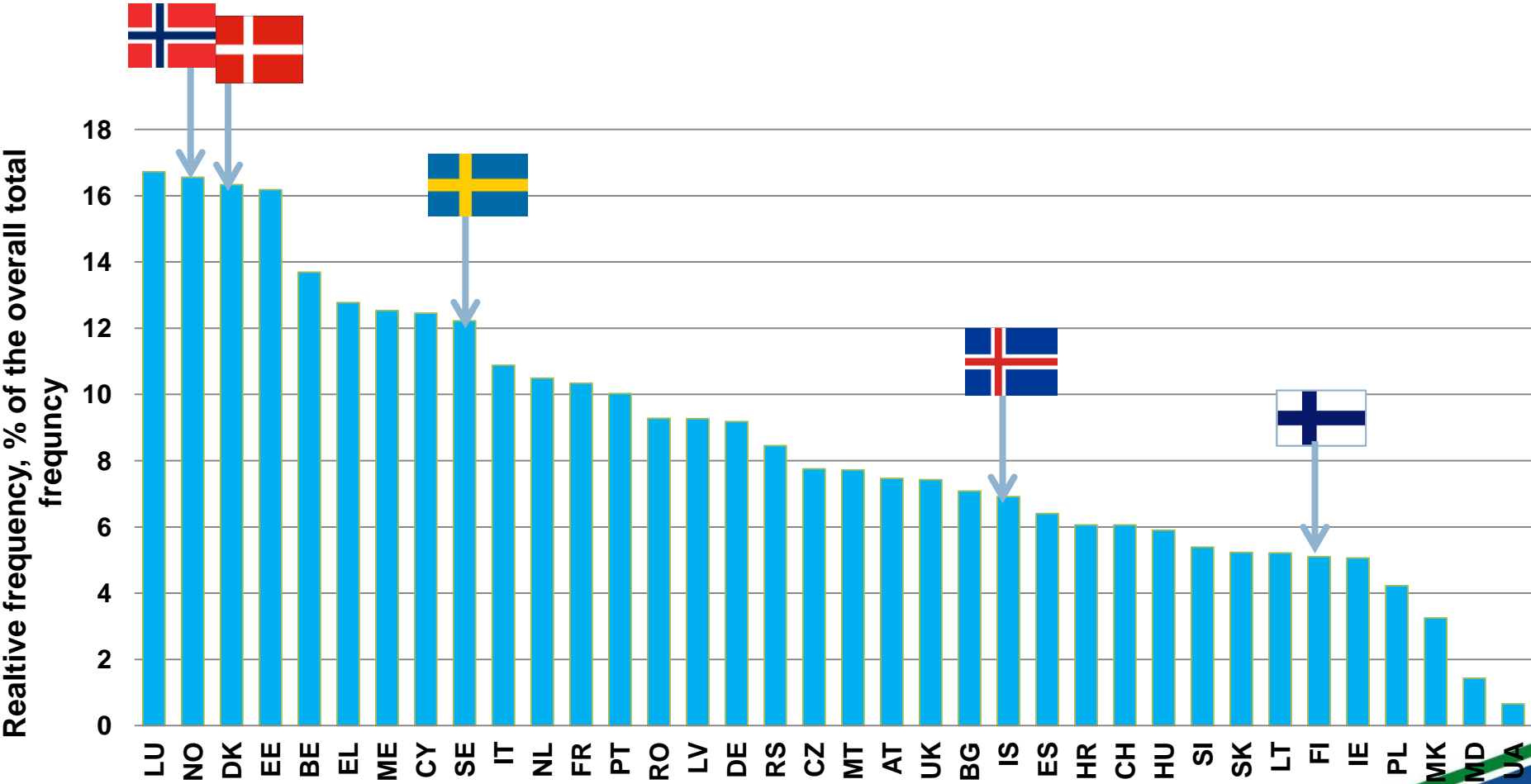


## X-RAY: FREQUENCIES PER 1000 POPULATION



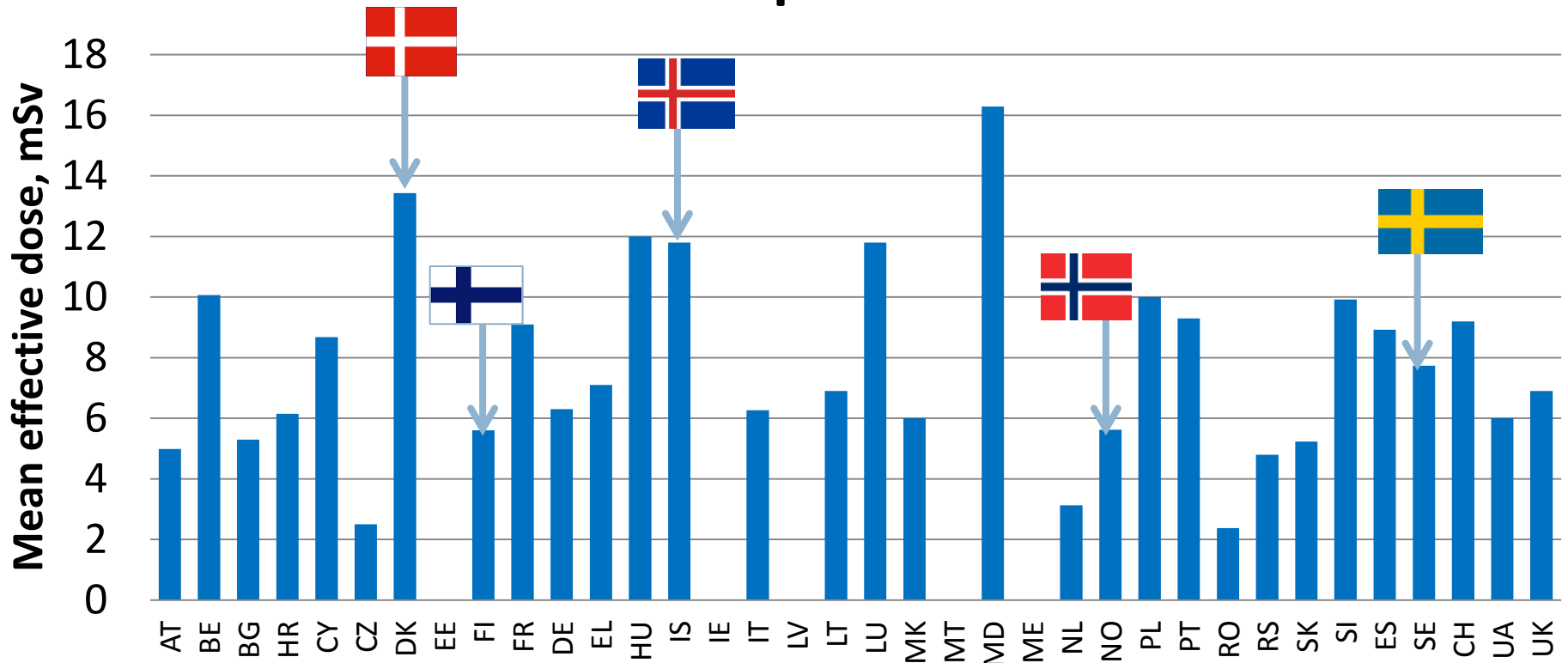
**European average: 1 examination per person per year**

# RELATIVE FREQUENCIES OF CT



## X-RAY: MEAN EFFECTIVE DOSES

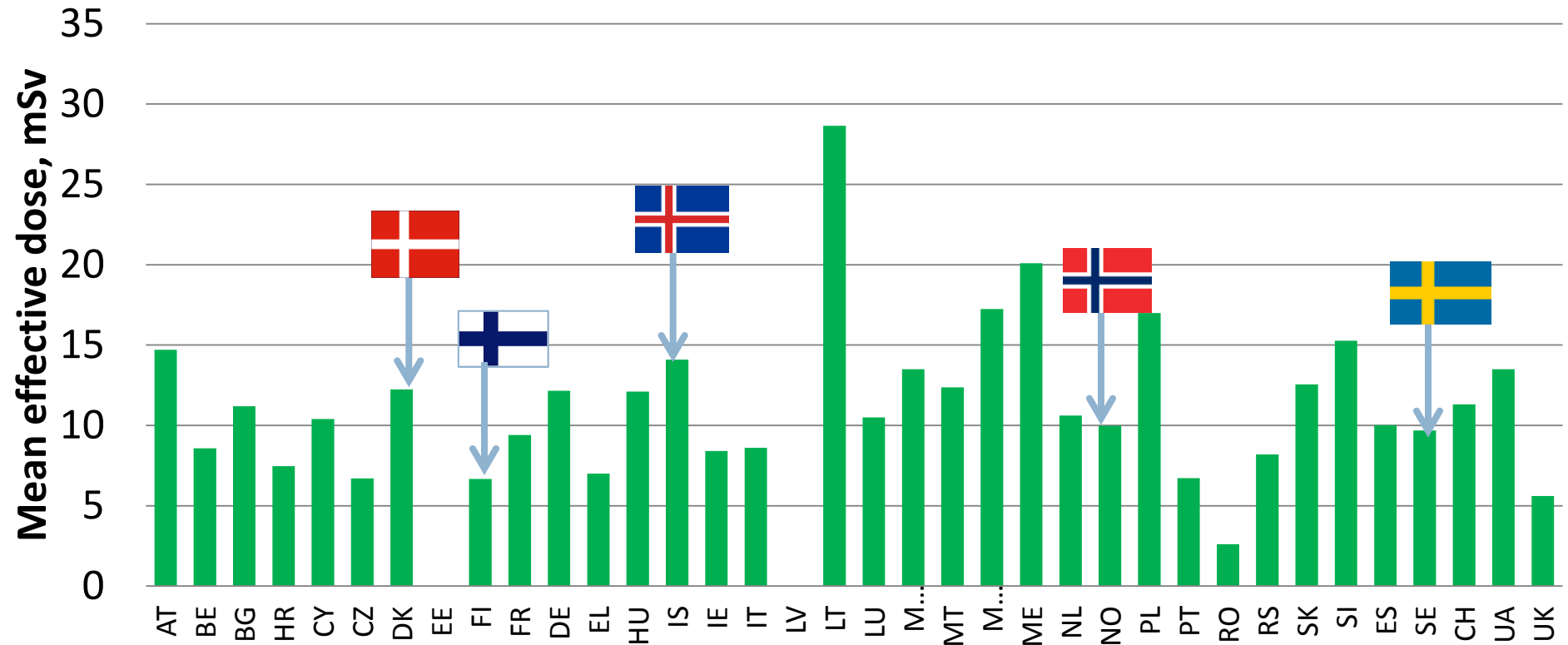
### CT spine



**Range 2-16 mSv; max/min 6**  
**Nordic range 6-13 mSv**

## X-RAY: MEAN EFFECTIVE DOSES

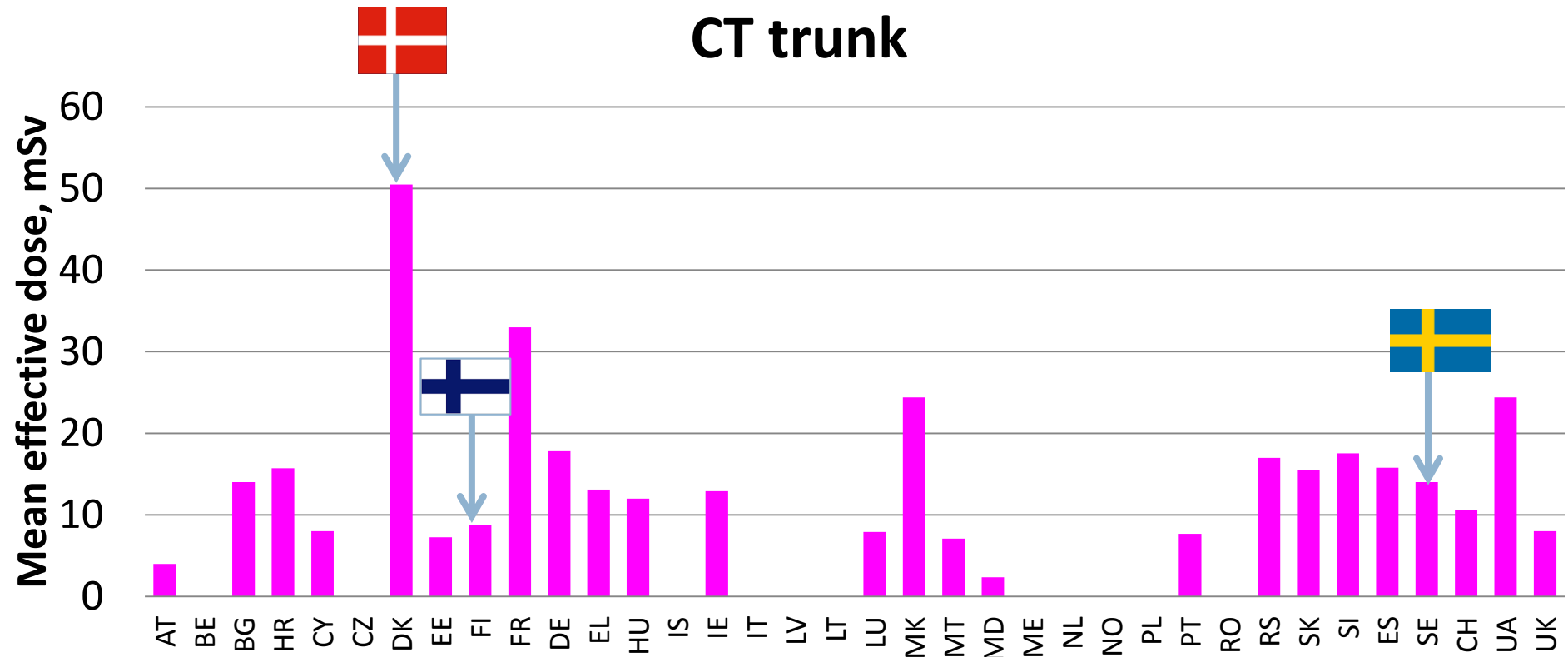
### CT abdomen



**Range 3-29 mSv; max/min 11**  
**Nordic range 7-14 mSv**

## X-RAY: MEAN EFFECTIVE DOSES

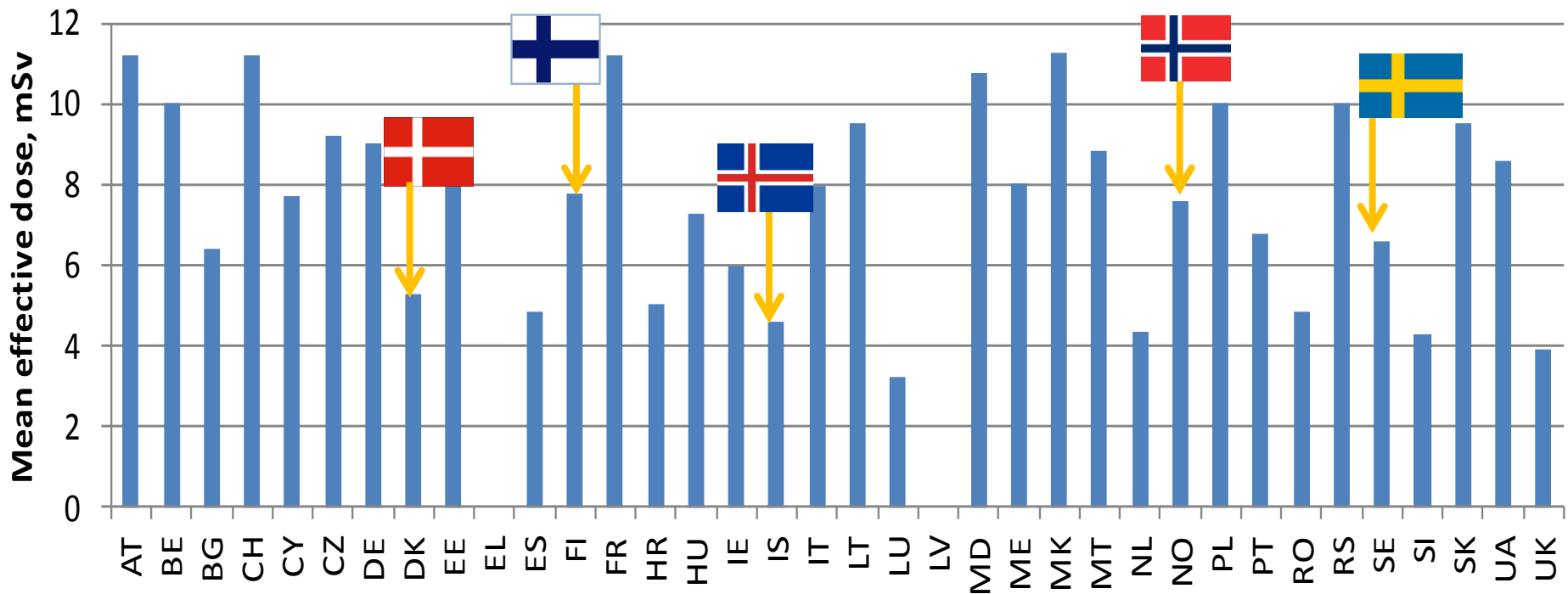
### CT trunk



**Range 2,3-50 mSv; max/min 22**  
**Nordic range 9-50 mSv**

## X-RAY: MEAN EFFECTIVE DOSES

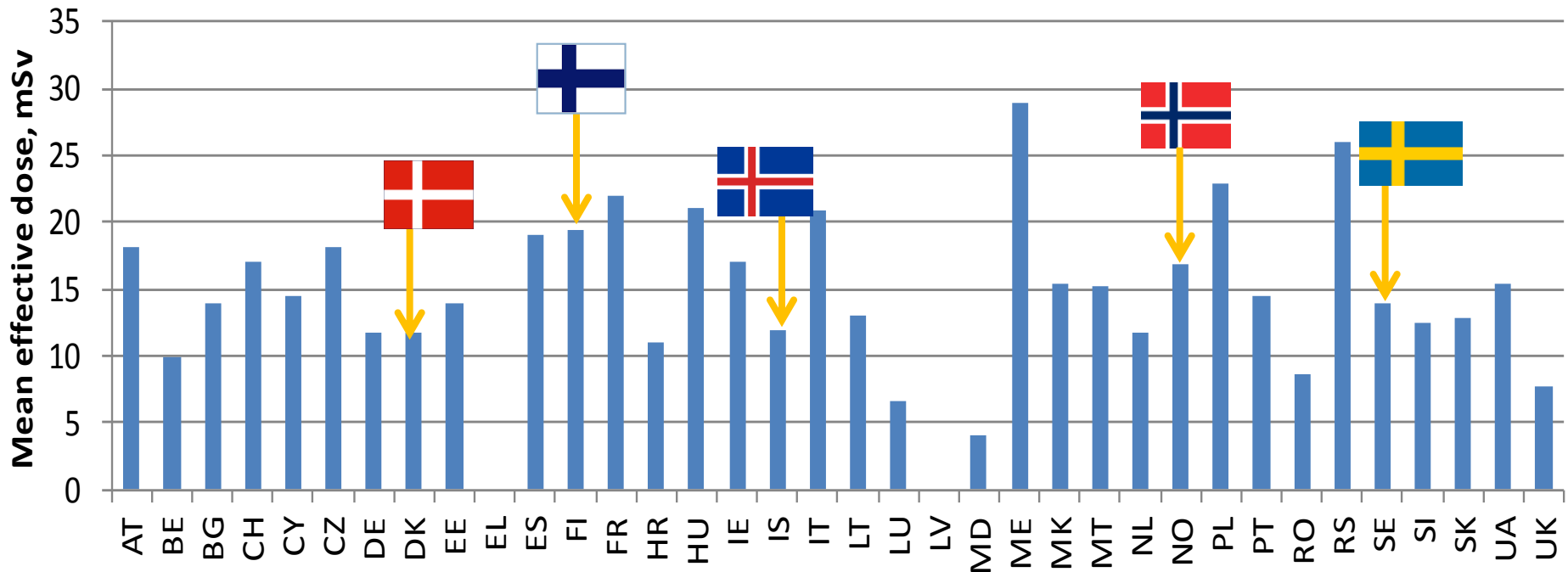
### Cardiac angio-graphy



**Range 3-11 mSv; max/min 4**  
**Nordic range 5-8 mSv**

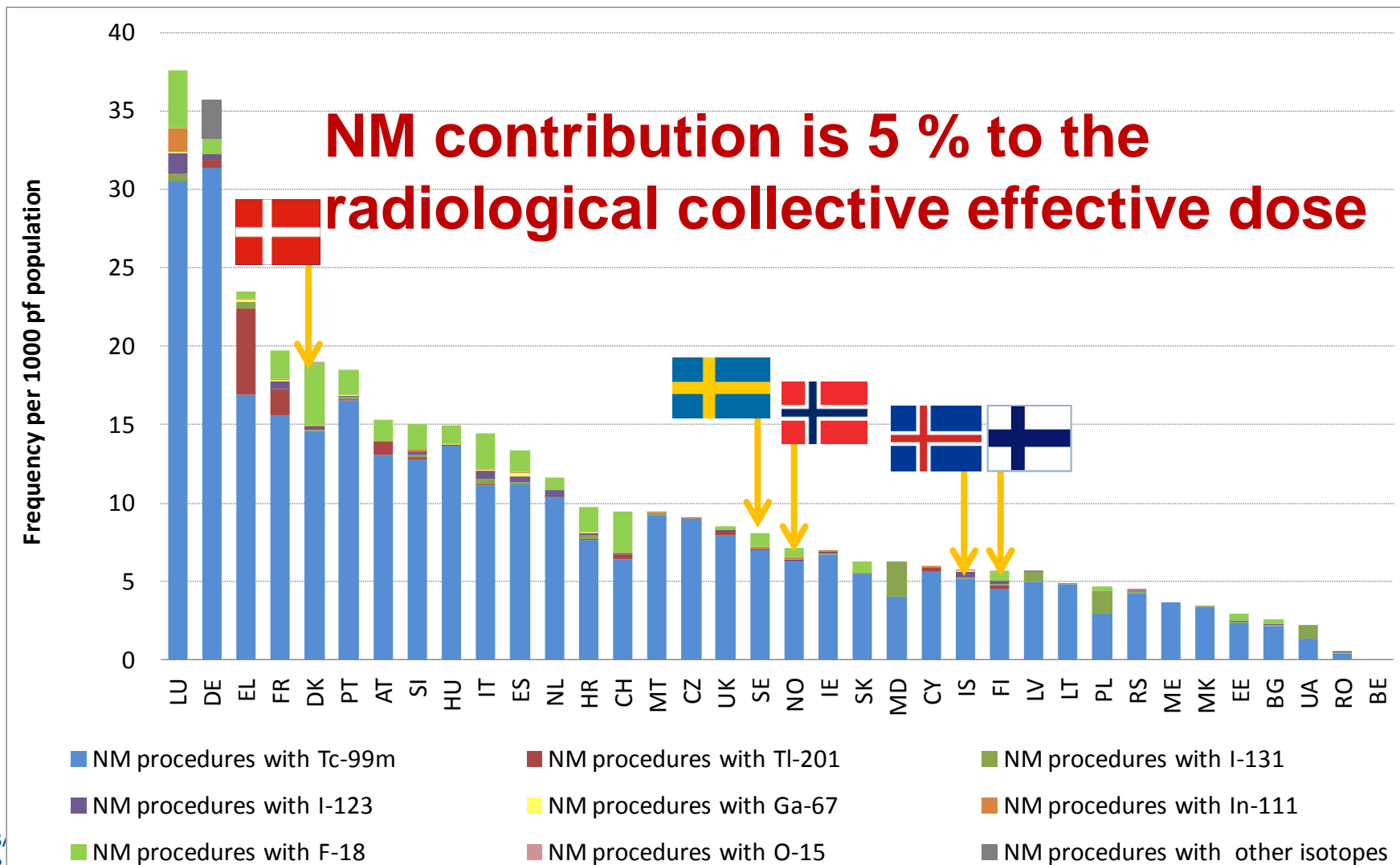
## X-RAY: MEAN EFFECTIVE DOSES

### PTCA



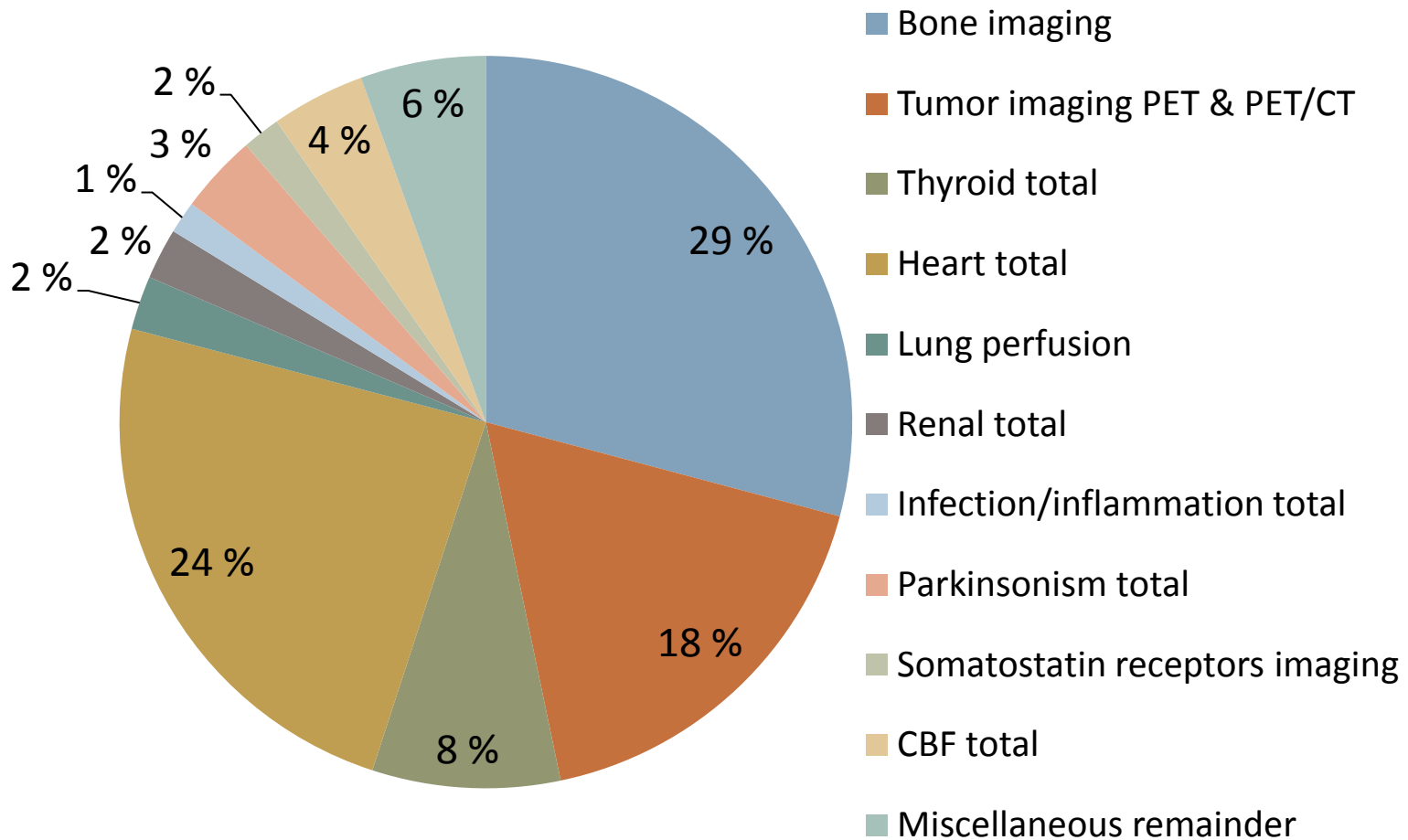
**Range 4-29 mSv; max/min 7**  
**Nordic range 12-20 mSv**

## NM: COLLECTIVE EFFECTIVE DOSES



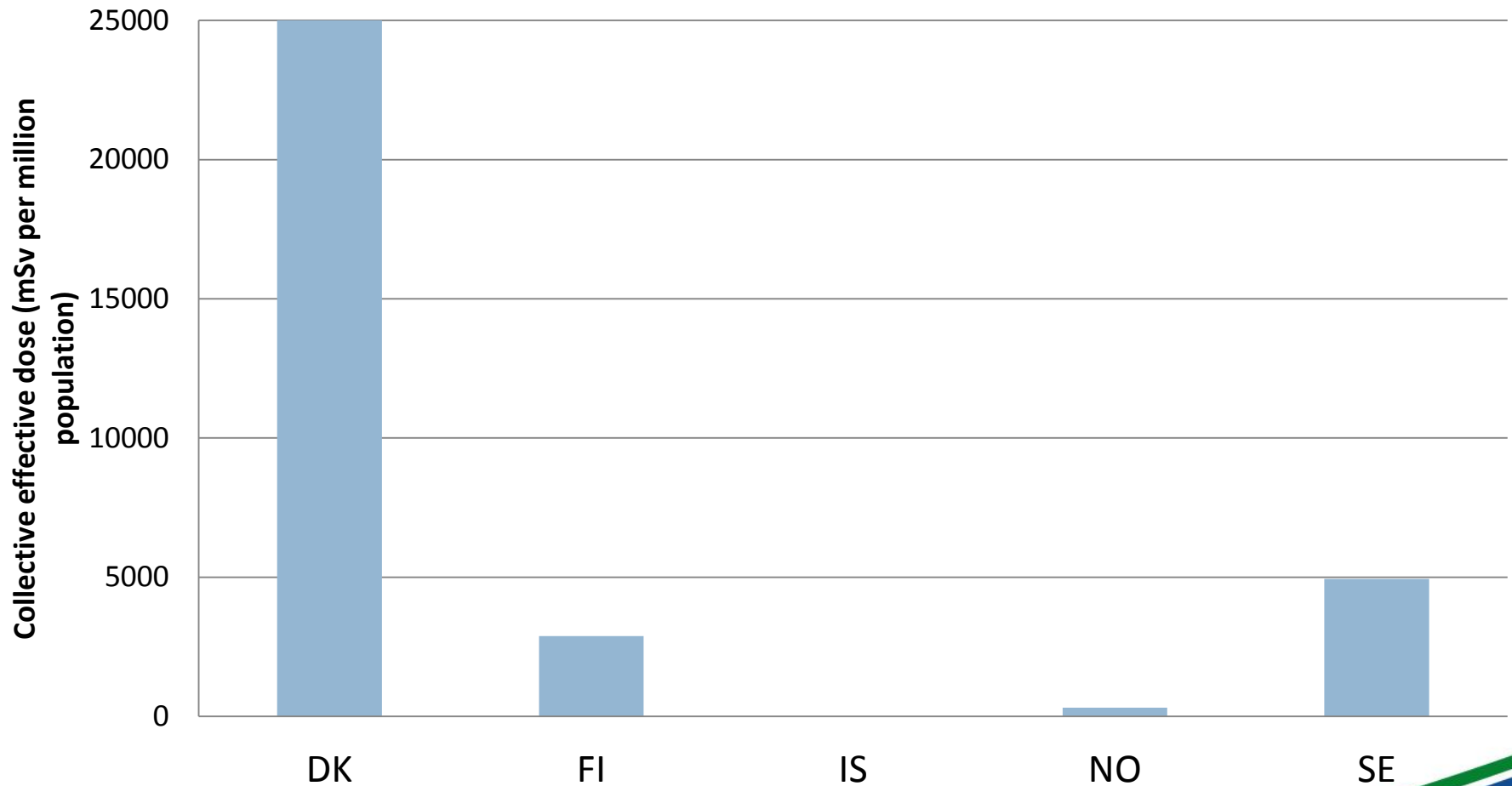


## NM: COLLECTIVE EFFECTIVE DOSES



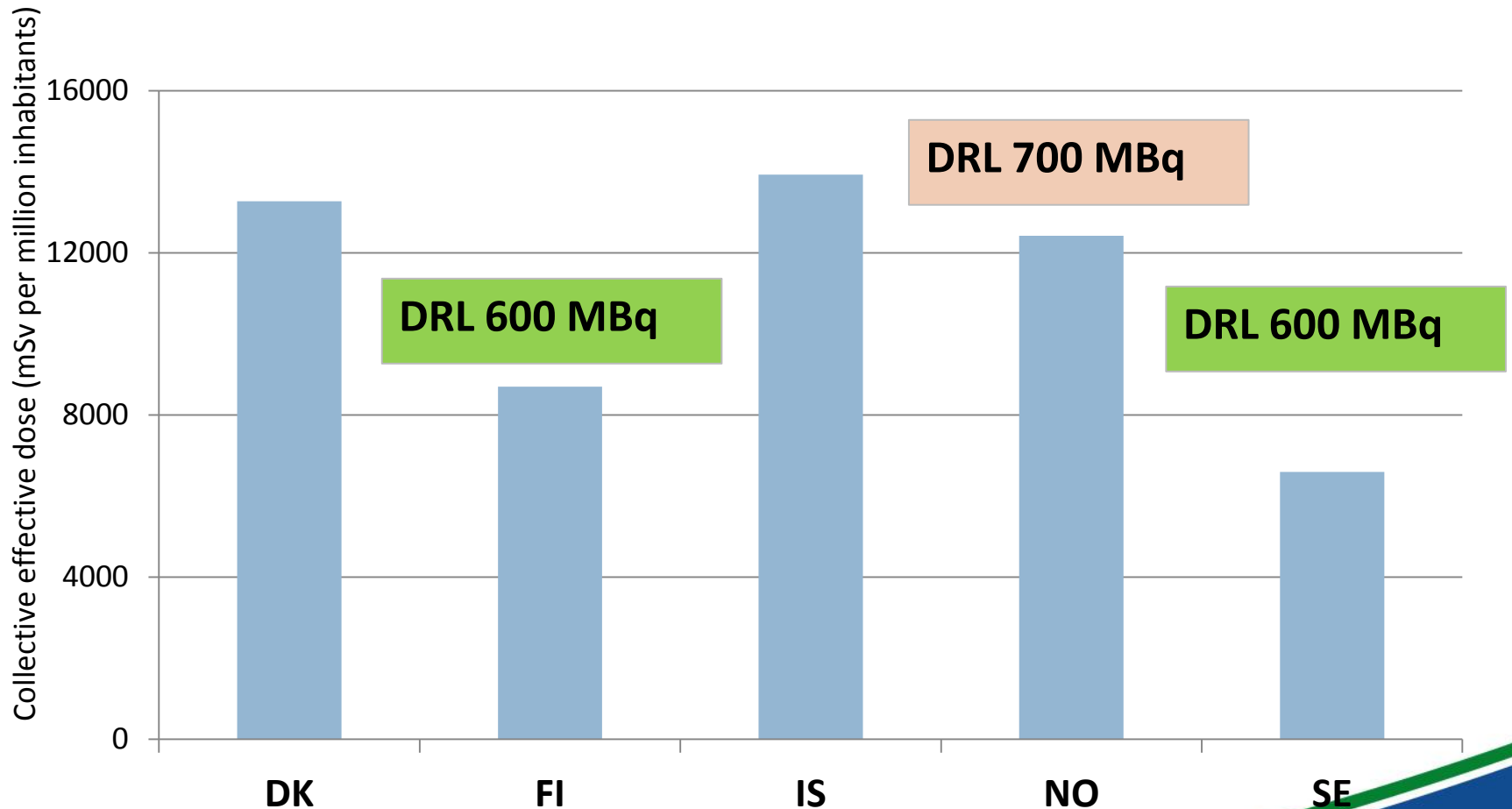
# NM: COLLECTIVE EFFECTIVE DOSES FROM PET-IMAGING

## Tumor imaging PET & PET/CT



# COLLECTIVE EFFECTIVE DOSE AND DRLs FOR OPTIMIZATION

## Bone imaging using Tc-99m



# Tools for justification and optimization



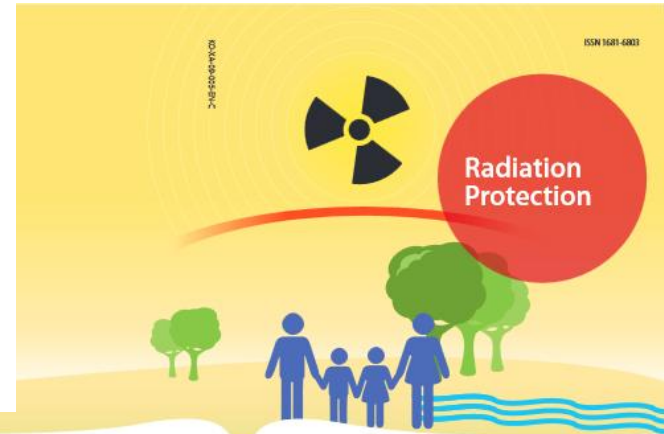
## Dosage Card (Version 1.2.2014)

Multiple of Baseline Activity

Weight kg	Class A	Class B	Class C	Weight kg	Class A	Class B	Class C
3	1	1	1	32	3.77	7.29	14.00
4	1.12	1.14	1.33	34	3.88	7.72	15.00
6	1.47	1.71	2.00	36	4.00	8.00	16.00
8	1.71	2.14	3.00	38	4.18	8.43	17.00
10	1.94	2.71	3.67	40	4.29	8.86	18.00
12	2.18	3.14	4.67	42	4.41	9.14	19.00
14	2.35	3.57	5.67	44	4.53	9.57	20.00
16	2.53	4.00	6.33	46	4.65	10.00	21.00
18	2.71	4.43	7.33	48	4.77	10.29	22.00
20	2.88	4.86	8.33	50	4.88	10.71	23.00
22	3.06	5.29	9.33	52-54	5.00	11.29	24.67
24	3.18	5.71	10.00	56-58	5.24	12.00	26.67
26	3.35	6.14	11.00	60-62	5.47	12.71	28.67
28	3.47	6.43	12.00	64-66	5.65	13.43	31.00
30	3.65	6.86	13.00	68	5.77	14.00	32.33

$$A[\text{MBq}]_{\text{Administered}} = \text{BaselineActivity} \times \text{Multiple}$$

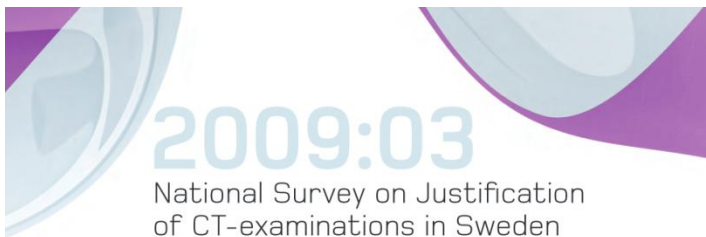
- Guidance
- Referral criteria
- DRLs
- Clinical audits
  - Self audits
  - External audits



[Eur Radiol.](#) 2009 May;19(5):1161-5. doi: 10.1007/s00330-008-1256-7. Epub 2009 Jan 21.

## Unjustified CT examinations in young patients.

[Oikarinen H<sup>1</sup>](#), [Meriläinen S](#), [Pääkkö E](#), [Karttunen A](#), [Nieminen MT](#), [Tervonen O](#).



Strålsäkerhetsmyndigheten  
Swedish Radiation Safety Authority

Sundhedsstyrelsen  
Statens Institut for Strålebeskyttelse

Statens strålevern  
Norwegian Radiation Protection Authority

GEISLAVARNIR RÍKISINS  
Icelandic Radiation Safety Authority

STUK

STATEMENT CONCERNING THE INCREASED USE OF COMPUTED TOMOGRAPHY IN THE NORDIC COUNTRIES

The Nordic Radiation Protection co-operation



*Thank you for your attention!*