

Ensuring the infrastructure
for a safe use of radiation in medicine

International perspective, current trends and challenges

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The contribution of Ionizing Radiation to Medical Procedures is of great benefit

- **Radiotherapy helps caring cancers**
 - 1/2 cancers cured thanks to IR
- **Ionizing imaging helps for diagnosis**
 - 1.2 exam/year/individual

Trends of medical exposure

- **Constant increasing of medical exposures**
 - Improvement of care and of access to care
 - Dissemination of techniques and equipments
 - Quick development of sophisticated techniques
- **Anywhere although most in developed countries**
 - Blatant in USA
 - Same trend in Europe and Asia
- **May become the main source of human exposure**
 - More than natural exposure
 - In France Nat = 2.4 mSv/y; Med = 2.5 mSv/y

Undesirable consequences

- **Second cancer is both a good and a bad news**
- **Unnecessary doses**
 - Overuse of imaging (US: 20% to 40% of CT scans could be avoided (Lehnert et al, J Am Coll Radiol. 2010;7(3))
- **Too much dose variations for a given act**
 - 1 to 100
- **Accidents may occur**

Medical Exposure in French Population (1)

Average effective dose per inhabitant increased by 57% between 2002 and 2007

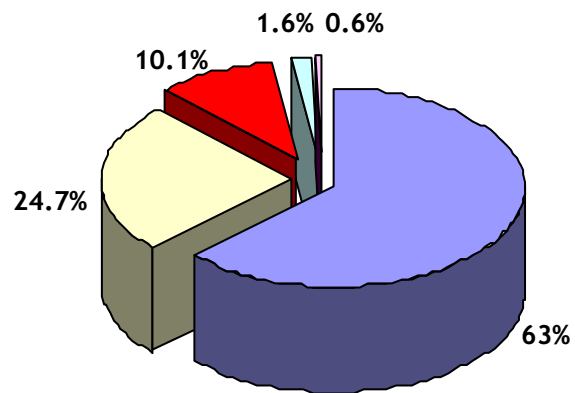
Year	Number of exams Total (million)	per inhabitant	Average individual effective dose per year (mSv)
2002	73.3	1.2	0.83*
2007	74.6	1.2	1.3

*Scanff et al., The British Journal of Radiology, 81 (2008), 204-213

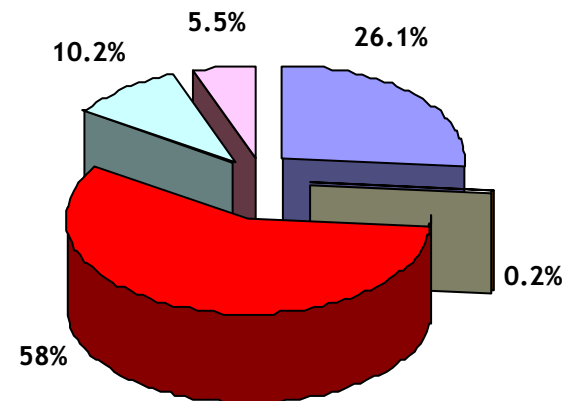
Medical Exposure in French Population (2)

More than 50% of the average effective dose per inhabitant is due to CT examinations

Number of examinations in 2007
(74.6 million)



Average effective dose per inhabitant in 2007
(1.3 mSv/year/inhabitant)

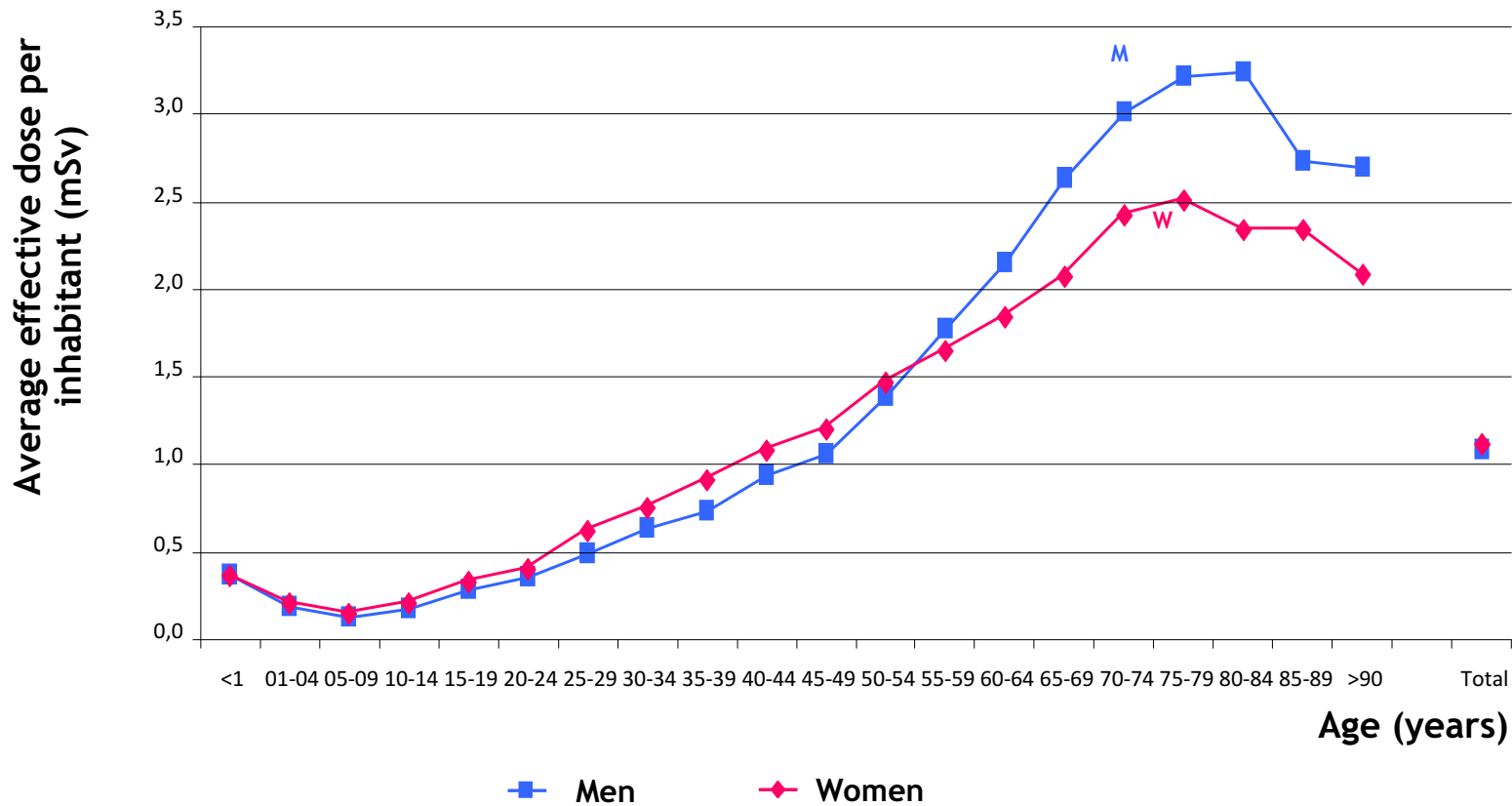


■ Conventional radiology
■ Dental radiology
■ Computed tomography

■ Nuclear medicine
■ Diagnostic interventional radiology

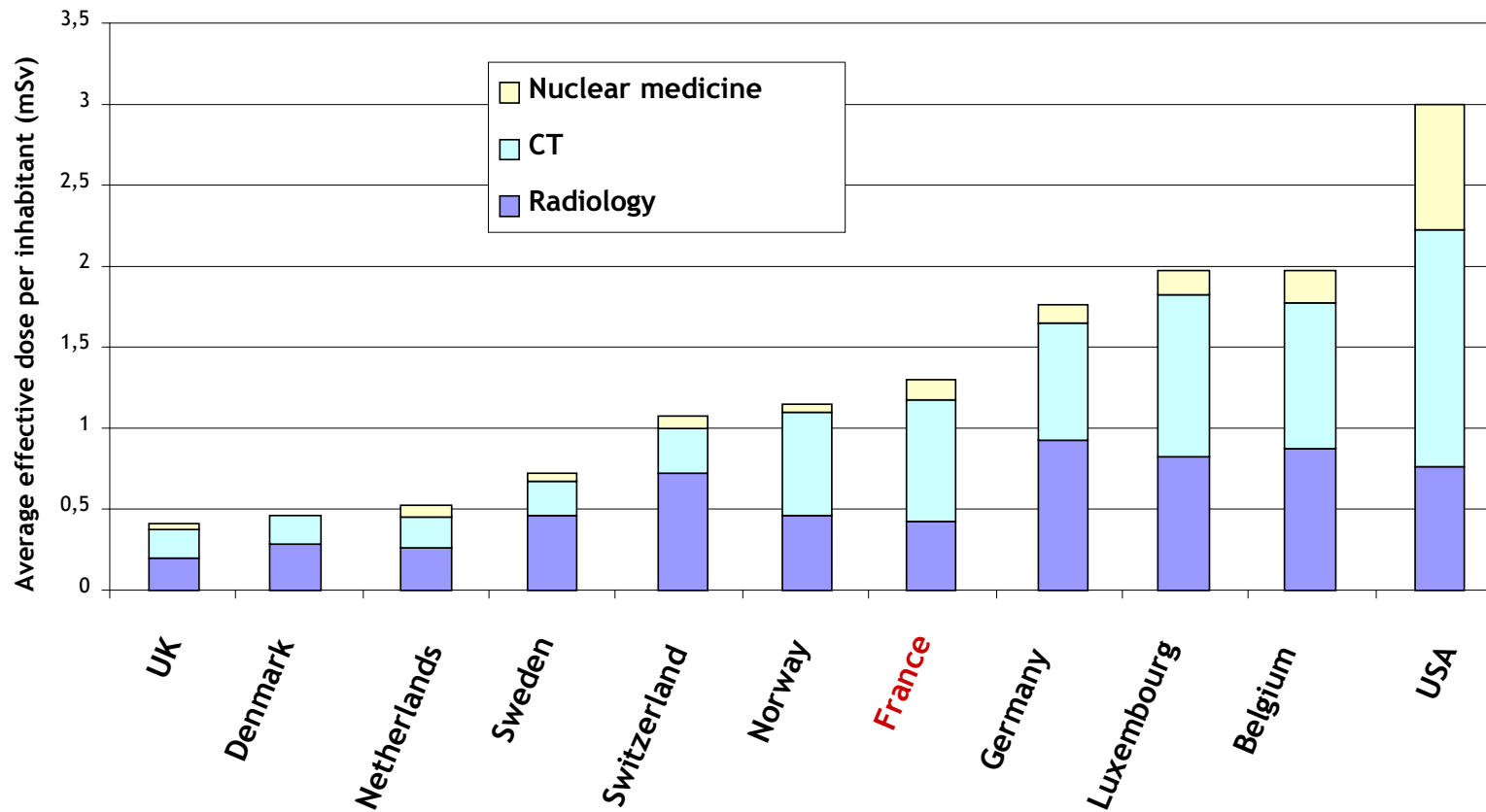
Medical Exposure in French Population (3)

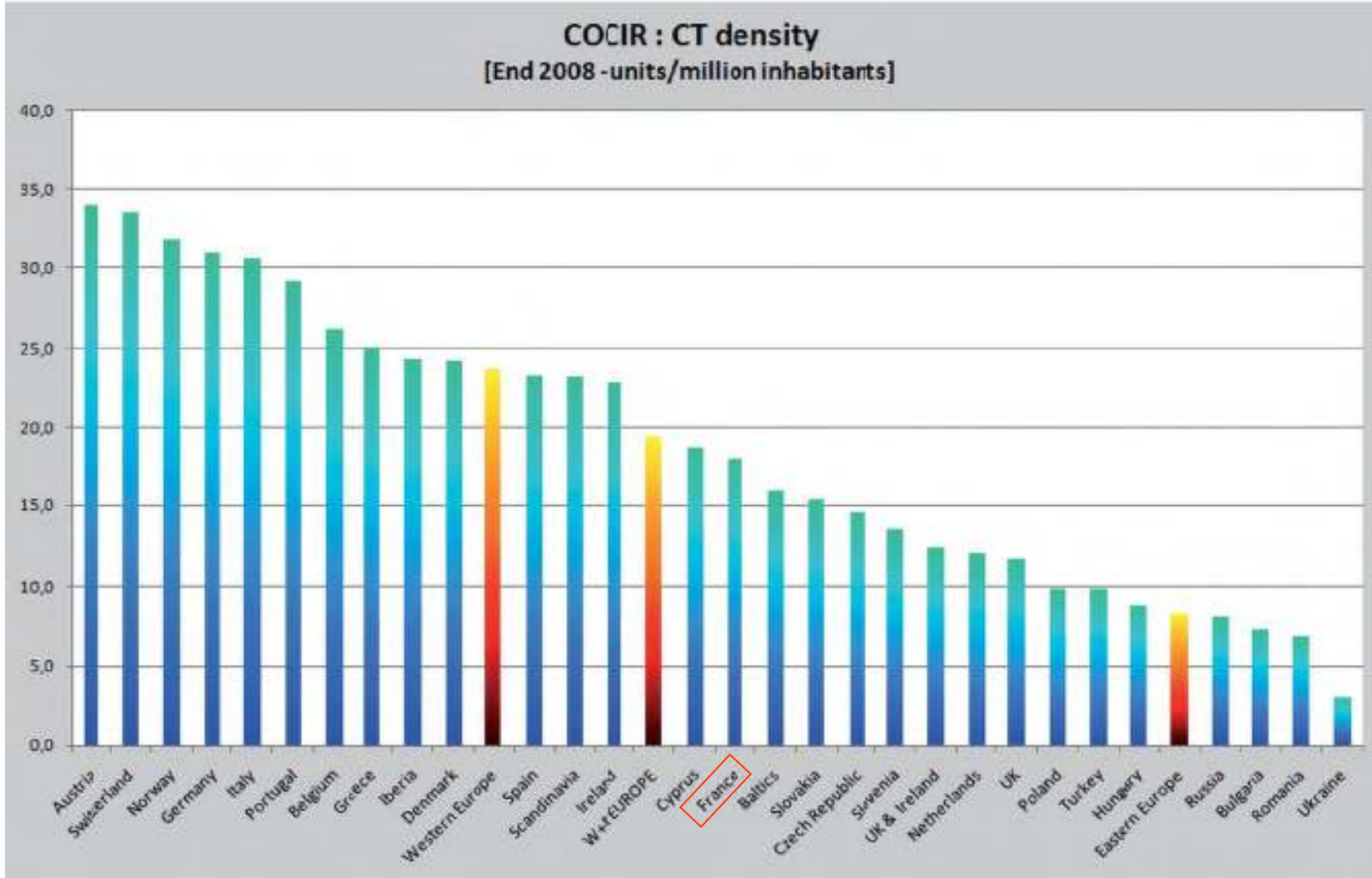
Average effective dose per inhabitant in 2007 due to X-ray examinations according to age and sex of the patient



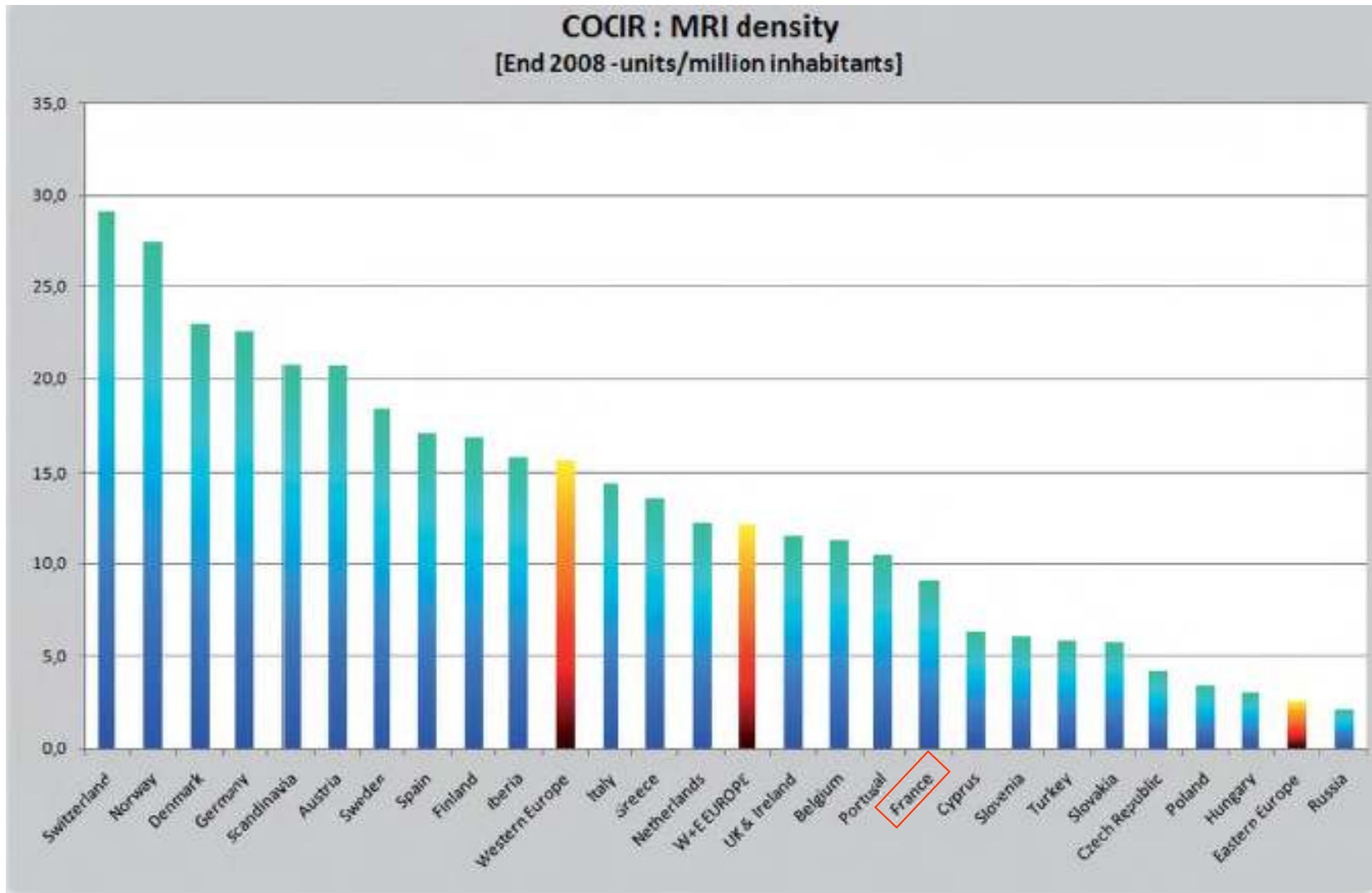
Comparison with international data

Average effective dose per inhabitant





Mean western Europe: ≈ 24 units/M inhabitants
 France: ≈ 18 "



Mean western Europe: ≈ 15.6 units/M inhabitants
 France: ≈ 9.1 "

Accidents may be severe

■ Epinal, France, 2004-05

- Radiotherapy
- 24 patients overexposed (20%), 5 deaths
- 400 patients overexposed (8%), disorders

■ San-Jose, Costa Rica, 1996

- Radiotherapy
- Wrong calibration after source replacement
- 115 patients overexposed (60%), 17 deaths

■ Indiana, USA, 1992

- Curietherapy
- 1 patient, source 20 Gy left in body, 1 death

What are the conditions to control Medical Exposures?

- Application of International Standards (ICRP, IAEA, WHO)
 - Justification of medical procedures
 - Optimisation of protection
- Prevention of Medical Accidents
- Development of awareness and RP culture

Justification of Medical Procedures

■ Three levels of justification

- The use of radiation in medicine
- A specified procedure
- The application of a procedure to an individual patient

■ Responsibility of Prescriber and Practitioner

- For the third level

Optimisation of Protection

■ Diagnostic Reference Levels

- Mechanism to manage patient dose to be commensurate with the medical purpose

■ Adequate quality image

- The nicest is not the most appropriate

■ Attention paid to sensitive groups

- Paediatrics, pregnant women
- Appropriate calibration

■ Appropriate use of alternatives

- Echography
- MRI

Prevention of Medical Accidents

- **Better training**
 - Of ALL medical practitioners
- **Regulation strengthened and enforced**
 - Inspection, dialogue
- **Development of good practices**
 - Written procedures
 - Quality control and assurance
- **More Medical Physicists**
- **Notification of incidents**
 - Systematic investigations
 - Feedback of experience (for design of devices)

Development of Awareness and RP Culture

- **Standards unknown by practitioners**
 - Insufficient dissemination

- **RP culture versus Medical culture**
 - Ionizing radiation associated with care, not with harm
 - Usually high doses (therapy)
 - Professional relationship: Medical practitioner versus Medical physicist

3 Challenges to take up

- **Involvement of professional societies**
 - Not only medical societies
- **Involvement of manufacturers**
 - Of devices and equipments
- **Involvement of patients**
 - More transparency is needed (delivered dose)