Safety culture in radiological departments

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FANC AFCN

federaal agentschap voor nucleaire controle

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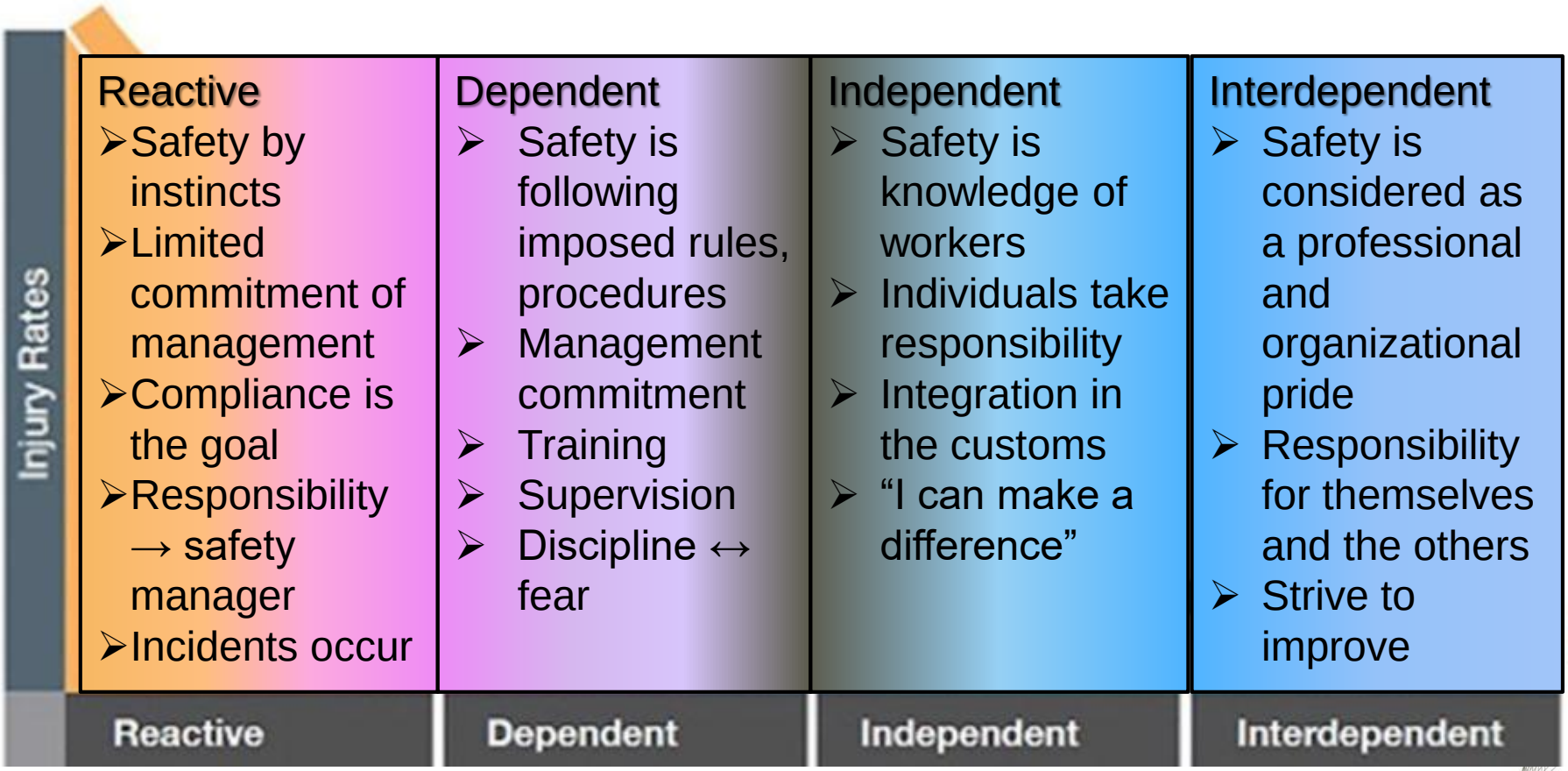
Safety culture

- **Safety culture**
- Medical exposures
- Justification
- Optimization
- Dose limits
- Communication
- Incident management
- Audit
- Conclusion

Safety culture

Dupont-Bradley curve



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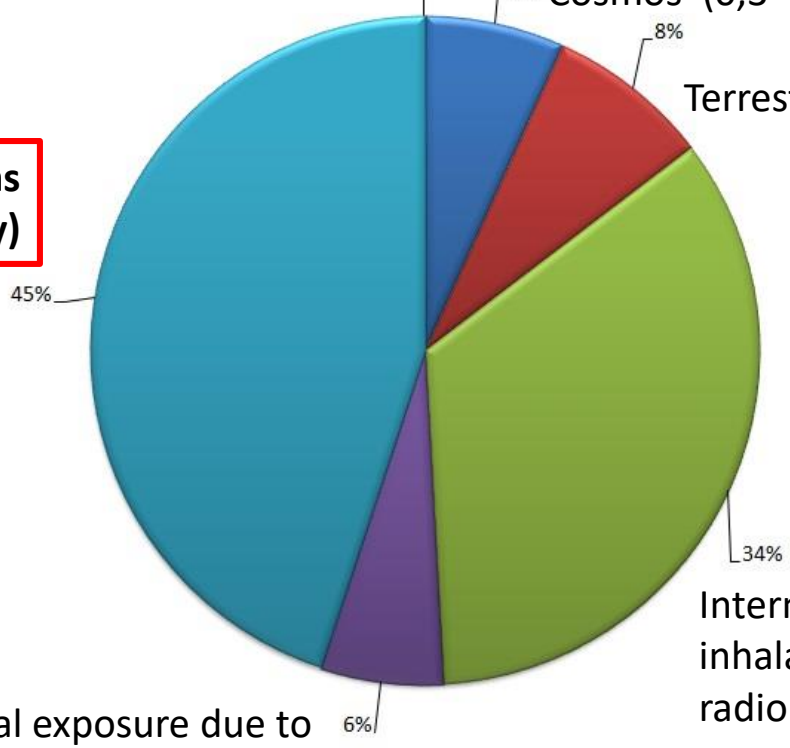
Medical exposures

Population exposure to ionizing radiation in Belgium



Total average exposure per caput : **5,1 mSv/y**

Medical exposures

Medical exposures are **important**

- More people exposed than from any other human activity
- Potentially high individual doses
- Increasing!

Medical exposures are **different**

- Exposure of individuals (i.e. patients) is inherent (not a side-effect)
- No dose limits for patients

Medical exposures are **complex**

- Greatest risk is often not ionizing radiation (e.g. trauma, disease)
- Patient ↔ staff and environment

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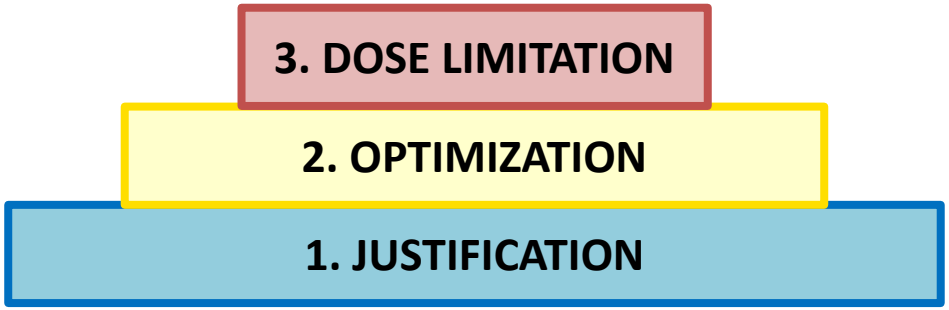
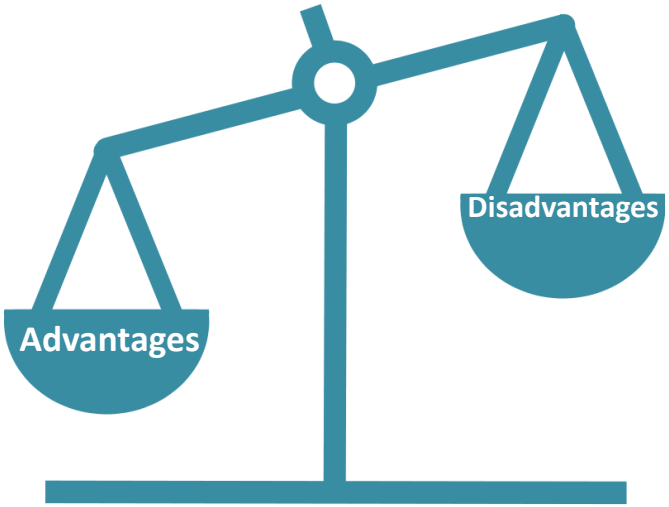
Base principles of radiation protection



Justification

A journey into justified medical exposures

Medical examination



“doing more good than harm”

Three levels of justification:

Level 1	Use of radiation in medicine
Level 2	Defined radiological procedures
Level 3	Procedure for an individual patient

Justification

Three levels of justification:

Level 1	***Justification of use of radiation in medicine***
Level 2	Justification of defined radiological procedures
Level 3	Justification of a procedure for an individual patient

At the first and most general level, the use of radiation in medicine is accepted as doing more good than harm.
Its overall justification is taken for granted.

Justification

Three levels of justification:

Level 1 Justification of use of radiation in medicine

Level 2 Justification of defined radiological procedures

Level 3 Justification of a procedure for an individual patient

General justification of specific procedure, for specific objective

- Framework by (inter)national healthcare and radiological protection bodies and authorities → imaging/treatment guidelines based on symptoms, suggested diagnosis, …

- Are there better alternatives available?
- Alternative that does not use ionizing radiation?
- Not only patients, also staff and public

→ **Justification study** for new acts
(new type of procedures, equipment, products, …) !!

Justification

Three levels of justification:

Level 1 Justification of use of radiation in medicine

Level 2 Justification of defined radiological procedures

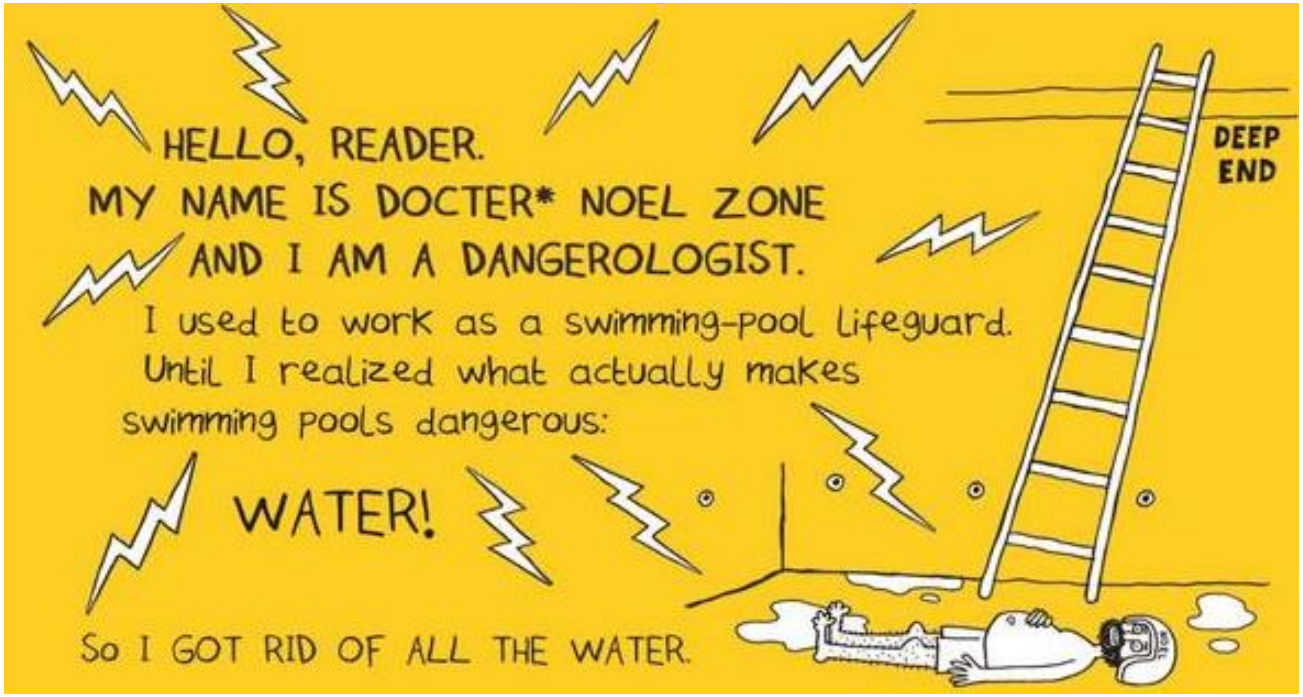
Level 3 Justification of a procedure for an individual patient

Specific objectives, specific characteristics of the patient

- Patient history/age/…
- Previous and future treatment
- Is the required information not yet available?
- Are there other examinations planned?
- Expected dose to the patient
- Benefit/risk analysis

Justification

What makes justification sometimes difficult?



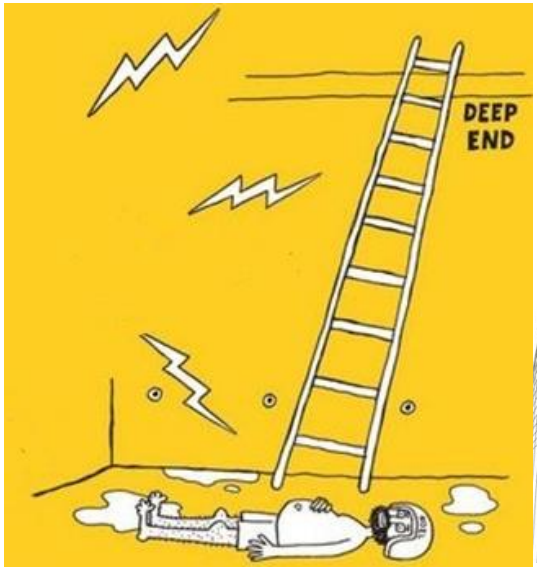
- Radiation risk is one of many risks
- Often forgotten because the exposure is usually inherent to the procedure
- Usually no directly visible effects

David O'Doherty, Chris Judge, *Danger Is Everywhere: A Handbook for Avoiding Danger*, 2014 by Little, Brown Books for Young Readers

Justification

What makes justification sometimes difficult?

- Frequency of radiological procedures has tremendously increased
- Lower dose examinations (Should we justify them? → yes!)
- "Go with the flow" & inertia towards changes
- Economical drivers & consumerist trends – medical tourism
- Defensive medicine
- Easy access and self presentation
- Awareness of risks is too low
- Communication failure
  (between healthcare professionals and
  between healthcare professionals and public)



Linet et al., "*Cancer risks associated with external radiation from diagnostic imaging procedures",* CA Cander J Clin 2012; 62:75-100

Malone et al, "*Justification of diagnostic medical exposures: some practical issues. Report of an IAEA Consultation*", BJR, 85 (2012), 523-538

Justification

Basis of justification = education

- Awareness
- Installation of justification processes (adapted to the complexity of the medical procedures)
- Practitioner = expert of application
  → final justification
  based on input from referrer and other involved MDs on the patient's history and current status

Justification

Staff should be knowledgeable !

Fast changing area: keep your knowledge up to date

- New techniques and equipment
- Options on the equipment
- Associated doses

Be aware of your local doses and typical doses for a certain procedure and the associated benefits and risks

→ needed in the justification process

→ needed to assess new techniques and evolutions

Justification

Pregnancy

www.fanc.be > bevolking > Zwanger? Vermijd straling

www.fanc.be > population > Enceinte ? Evitez les rayons

Verify if your female patient could be pregnant!

Justification

Children

Stralingsbelasting in de neonatologie in België
www.fanc.be > Predos
Dose de rayonnement en néonatologie en Belgique
www.afcn.be > Predos

Justification

Children

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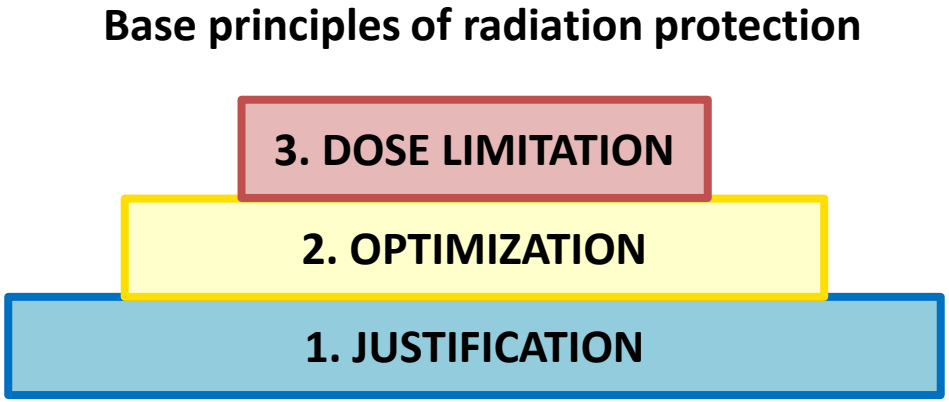
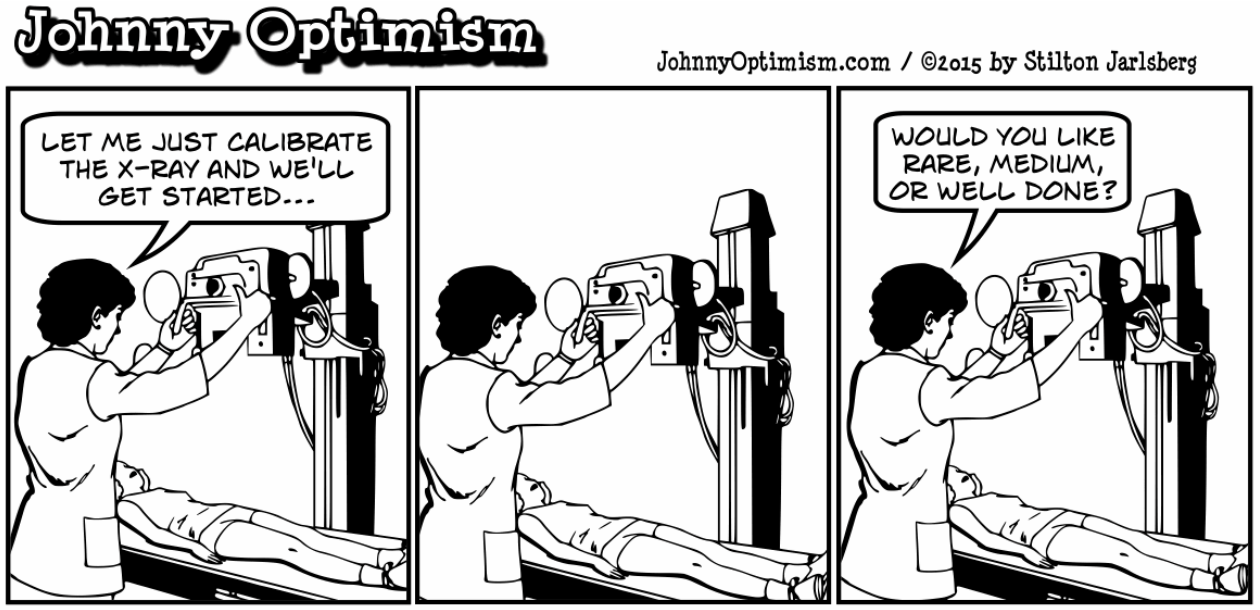


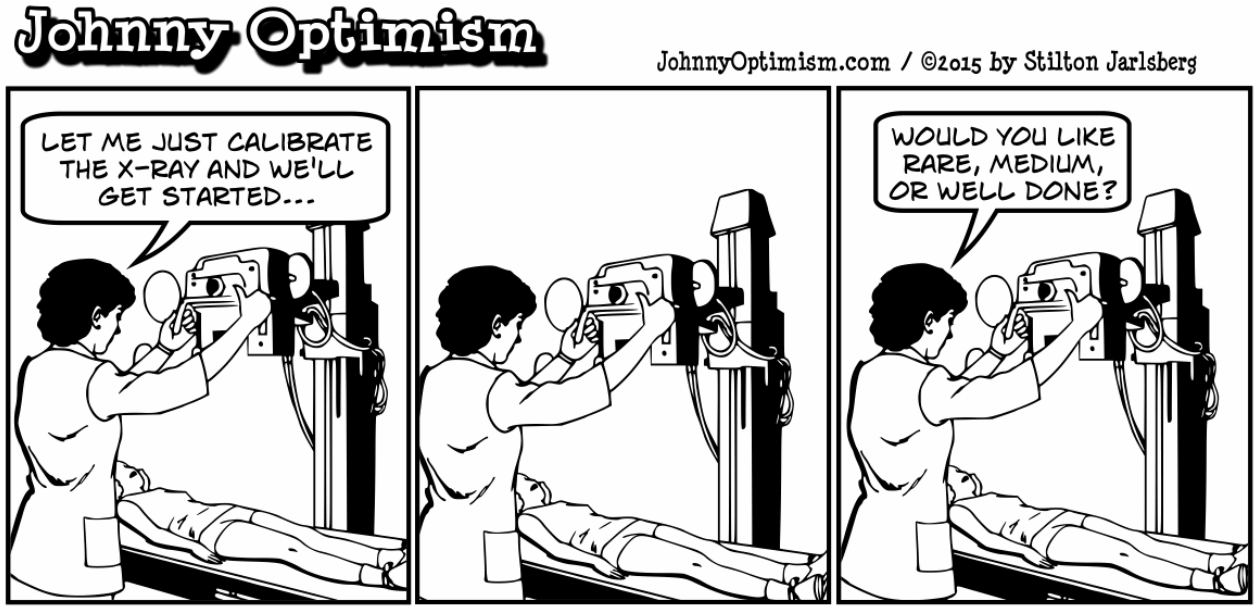
Optimization



After justification !!

Aim = to provide images adequate for diagnosis or treatment while keeping the dose ALARA

Optimization



After justification !!

Different areas:

- Imaging procedure
- Equipment and devices
- Staff

Optimization

Imaging procedure

Produce the clinically required information

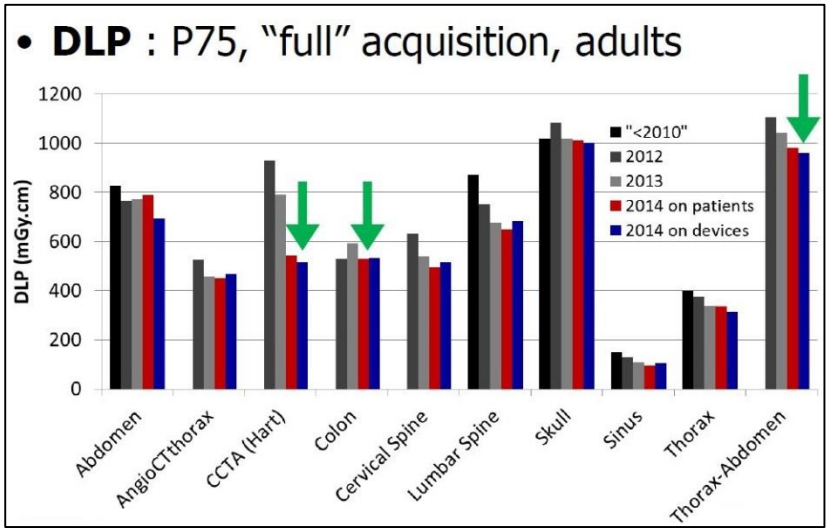
- Set up and use procedures
- Standard protocols and individual adjustment of scan parameters
- Consider dose reduction techniques
- Keep sufficient diagnostic quality (exam with lowest dose not necessarily the best!)
- Dose studies

FANC Dosimetry studies

FANC Decree Patient Dosimetry in Radiology

- Individual dose/dose parameters
- Online measurements for interventional radiology
- National dose studies → Diagnostic references levels - DRLs

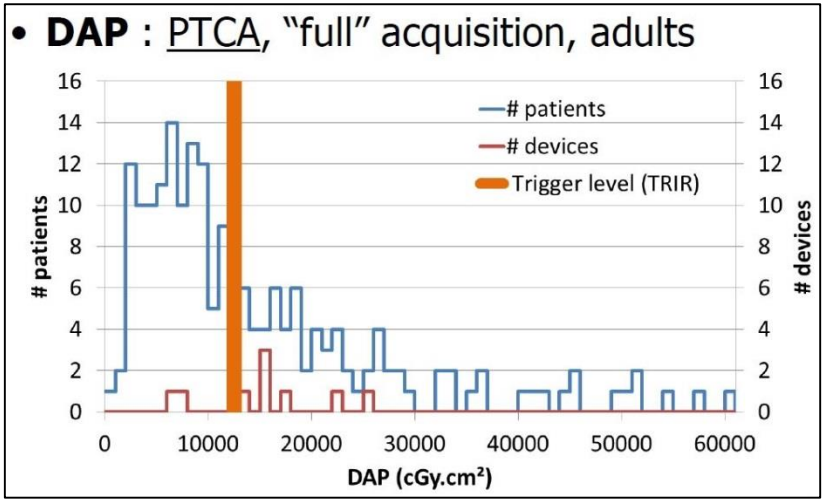
Conventional radiology & CT



Clear effort from most centers to optimize !
Progressive decrease for most examinations

Vanaudenhove et al., *"National diagnostic reference levels in radiology"*, 2016 – www.fanc.be

FANC Dosimetry studies



Interventional radiology

Awareness, prevention and follow-up of deterministic effects!

HUIDDOSIS BIJ INTERVENTIONELE PROCEDURES

Gebruik trigger niveaus:
Totale DAP > trigger niveau → informeren patiënt over mogelijk tijdelijk erytheem
Totale DAP > 2 x trigger niveau → informeren patiënt over mogelijke huidschade → zelfonderzoek & follow-up

TRIGGER NIVEAUS		DAP (Dose-area product) cGy.cm² µGy.m²	DAP (Dose-area product) mGy.cm²
TIPS & chemo embolisatie van de lever (TIPS : intrahepatische shunt via de vena transjugularis)		33.000	330.000
Cerebrale embolisaties	monoplane	17.500	175.000
	biplane	24.000	240.000
RF ablatie		18.000	180.000
Biliaire drainage	conventioneel	16.000	160.000
	PTC	18.000	180.000
Embolisatie vena spermatica		27.000	270.000
ERCP (endoscopsche retrograde cholangio-pancreatografie)		29.500	295.000
CA & PTCA (coronaire angiografie & coronaire transluminale percutane)		12.500	125.000

MEER INFORMATIE
kan verkregen worden op de website van het FANC:
www.fanc.fgov.be
of bij uw erkende stralingsfysicus

Hoe stralingsschade aan de huid voorkomen ?

- Maximaliseer afstand tussen patiënt en X-stralen buis
- Minimaliseer afstand tussen patiënt en beelddetector
- Minimaliseer de fluoroscopietijd en het aantal acquisitie beelden
- Varieer de ingangspositie van het stralingveld (varieer de bundelprojecties)
- Minimaliseer het gebruik van grote projectie-hoeken
- Gebruik een geschikte veldcollimatie
- Beperk vergrotingen tot een minimum
- Gebruik extra koperfiltratie
- Gebruik de beschikbare middelen voor dosis reductie (gepulste scopie, last image hold)

FANC
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Cette publication est également disponible en Français

DOSE À LA PEAU LORS DE PROCÉDURES INTERVENTIONNELLES

Utilisation de niveaux de dose d'alerte:
DAP totale > niveau de dose d'alerte → informer le patient de la possibilité de développer un érythème transitoire
DAP totale > 2 x niveau de dose d'alerte → informer le patient de la possibilité de lésions cutanées → observation et suivi médical

NIVEAUX DE DOSE D'ALERTE (trigger levels)		DAP (produit dose-surface) cGy.cm² µGy.m²	DAP (produit dose-surface) mGy.cm²
TIPS & chimio embolisation du foie (TIPS : shunt intrahépatique par voie transjugulaire)		33.000	330.000
Embolisation cérébrale	en monoplan	17.500	175.000
	en biplan	24.000	240.000
Ablation par RF (radiofréquence)		18.000	180.000
Drainage biliaire	conventionnel	16.000	160.000
	Par PTC (cholangiographie transhépatique percutanée)	18.000	180.000
Embolisation de la veine spermatique		27.000	270.000
ERCP (cholangio-pancréatographie rétrograde endoscopique)		29.500	295.000
CA & PTCA (angiographie coronaire & angioplastie coronaire transluminale percutanée)		12.500	125.000

PLUS D'INFORMATION
disponible sur le site web de l'AFCN :
www.afcn.fgov.be
ou auprès de votre radiophysicien agréé

Comment prévenir les lésions cutanées dues aux rayonnements ionisants ?

- Maximiser la distance patient / tube de rayon X
- Minimiser la distance patient / détecteur d'image
- Minimiser le temps de fluoroscopie et le nombre d'aquisitions
- Varier la position d'entrée du champ de rayonnement (varier la projection des faisceaux)
- Minimiser l'utilisation de projection grand angle
- Utiliser une collimation de champ adaptée
- Limiter l'agrandissement au minimum
- Utiliser un filtre de cuivre supplémentaire
- Utiliser les moyens disponibles pour réduire la dose (scopie pulsée, conservation de la dernière image)

AFCN
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pointcontact@fanc.fgov.be
Deze publicatie is ook beschikbaar in het Nederlands

Optimization

Imaging procedure

- Optimization does not necessarily mean “pure” dose reduction
- Attention towards patient positioning, image/scan range, …

“It’s a very nice bird, but it makes it difficult to see what’s wrong.”

Optimization

Equipment and devices

- Before purchase: benefit-risk analysis ***including*** RP and QC/QA
- At installation
  - Possibilities and possible points of attention
  - Commissioning ***before*** first clinical usage
  - Take enough time for fine tuning
- Be aware of the (dose-reductions) possibilities of your equipment and use them when possible
- During use
  - QC: minimal acceptability criteria **+** constant follow-up (daily, weekly, monthly, ...)
  - Proper maintenance and calibration
  - QA

Optimization

Equipment and devices

Nicole Denjoy, COCIR Secretary General

*"A **quarter of the European CT installed base cannot be upgraded with the most important dose-saving technology advances**, CT Dose Modulation and CT Reiterative reconstruction algorithm technologies. This is equivalent to approximately 2,500 units in Western Europe and 500 in Eastern Europe, which can now be considered inadequate from a radiation safety perspective."*

COCIR
SUSTAINABLE COMPETENCE IN ADVANCING HEALTHCARE
EUROPEAN COORDINATION COMMITTEE OF THE RADIOLOGICAL, ELECTROMEDICAL AND HEALTHCARE IT INDUSTRY

Be aware of the possibilities and shortcomings of your equipment with respect to new evolutions and ideas
and install a **replacement strategy** for your equipment

Optimization

Staff

- Proper education and application specific training
- Awareness and attitude
  - Working techniques and procedures
  - QA-systems
  - Knowledge of dose and identification of low/high doses (imaging protocols and individual patient)
- Staff doses: ALARA
  - Protective measures and personal dosimeters (check your dose!)
  - Attention towards staff positioning/patient contact

Optimization

Optimization is **team work**

Define the relevant stakeholders

practitioners, nurses, technologists/radiographers, medical physicists, manufactures, reception staff, …

Iterative process of continuous evaluation and review

Safety culture

- Safety culture
- Medical exposures
- **Justification**
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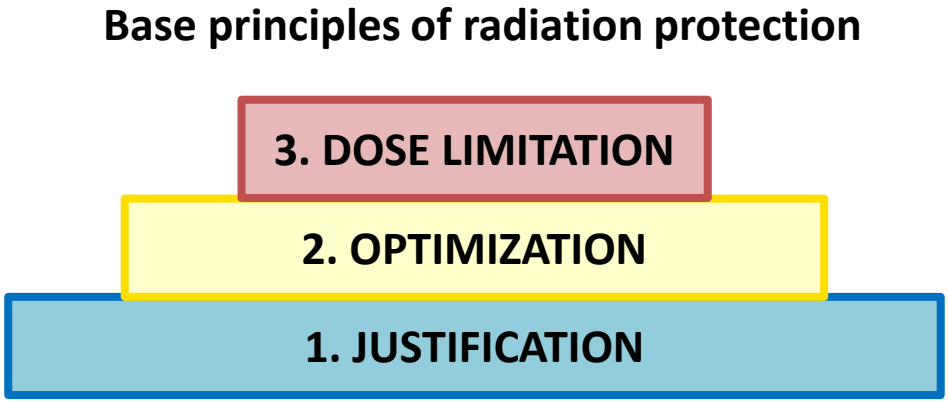

Dose limitation

European Directive 2013/59/EURATOM

Should be implemented by 2018

Dose limits for public and workers

	Public	Exposed workers	Students (16-18y)
Effective dose	**1 mSv per year**	**20 mSv per 12 consecutive months**	**6 mSv per year**
Equivalent dose			
Eye lens	**15 mSv per year**	**20 mSv per 12 consecutive months**	**15 mSv per year**
Skin (average dose for each 1 cm^2)	**50 mSv per year**	**500 mSv per 12 consecutive months**	**150 mSv per year**
Hands, arms, fore-arms, feet, legs and ankles	**NA**	**500 mSv per 12 consecutive months**	**150 mSv per year**

! DOSE LIMIT ≠ DOSE CREDIT !

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Patient communication

- Patients have the right to be informed[1]
- Extra attention for pregnant women and children
- Adequate information can only be given by knowledgeable persons
- Adapt your communication: patients have different background, capabilities:
  - Literacy (terminology, …)
  - Numeracy (concept of percentages, …)
  - Emotions, fear
  - What information does my patient want to know?

[1]Law on rights of patients - 22 August 2002

www.zuinign

www.pasder

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Medische be

geen vakant

COMMUNICATING RADIATION RISKS IN PAEDIATRIC IMAGING

Information to support healthcare discussions about benefit and risk

World Health Organization

Safety culture

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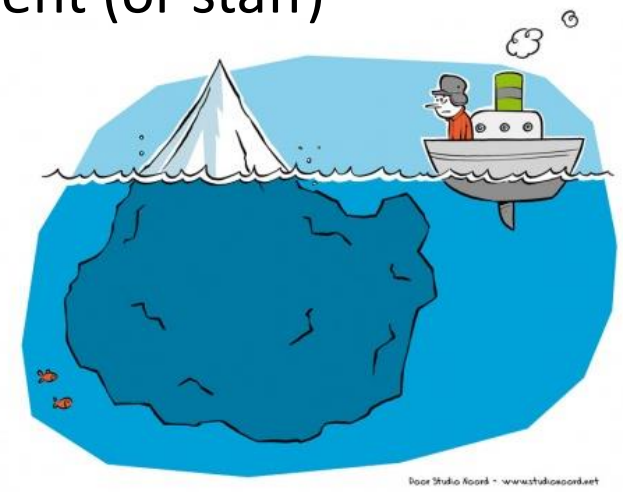
Incident management

Incident = an event or circumstance which could have resulted, or did result, in unnecessary harm to a patient or a staff member

Incidents in the medical world → iceberg

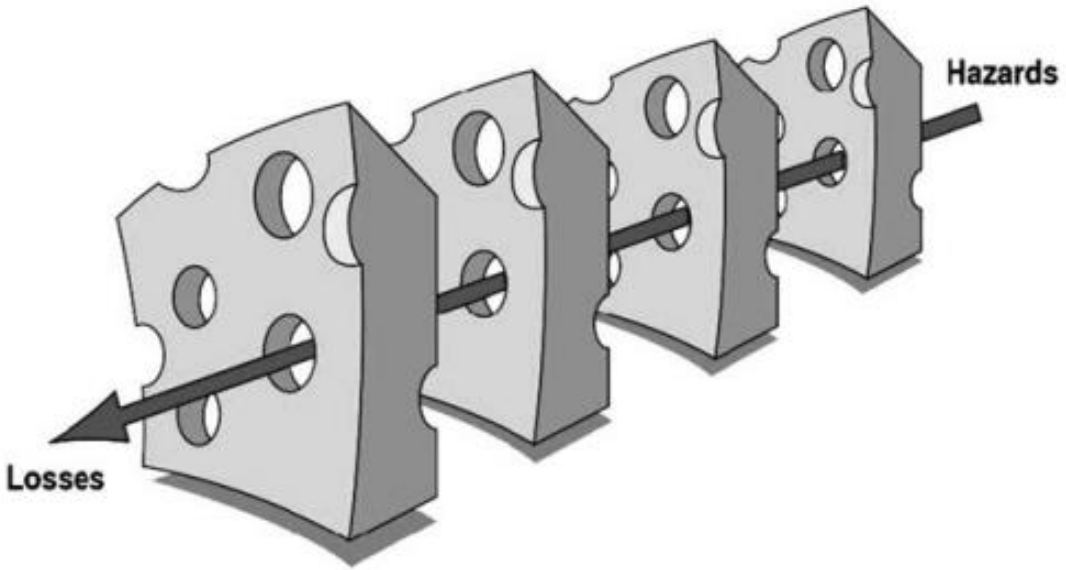
- Visible tip: effective harm for patient (or staff)
- Submerged part: near-incidents



Lau and Kwan-Hoong (Eds), "*Radiological Safety and Quality, Paradigms in Leadership and Innovation*", Springer, 2014.

Incident management

Swiss cheese model



Barriers

- Technical
- Organizational
- Person-related (training, attitude, condition)

Lau and Kwan-Hoong (Eds), "*Radiological Safety and Quality, Paradigms in Leadership and Innovation",* Springer, 2014.

Incident management

Nobody is perfect and no device is perfect
BUT ..
Learn from (your) mistakes and avoid new mistakes !

→ Incident reporting system = more than registration software

1. Registration
2. Reporting & Analysis
3. Solution development
4. Implementation
5. Audit & monitoring
6. Feedback

System should be:
- User-friendly
- Accessible
- Non-punitive

Lau and Kwan-Hoong (Eds), *"Radiological Safety and Quality, Paradigms in Leadership and Innovation"*, Springer, 2014.

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Audit

What?

Clinical audit = a systematic assessment of clinical practice

Quality and safety improvement

Improving not just checking where you are

- Patient care
- Justification (procedures and application)
- Optimization (procedures and application)
  - Patient dosimetry
  - Equipment
- Working procedures
- Incident management
- Education and training
- Staffing

Audit

How?

Review of practices, procedures and results using standards for good practice

Peer review!

Audit can be supported by software tools but not replaced!

Who?

Multidisciplinary team (physicians, physicists, nurses, radiographers, …)

Modalities?

Legal obligation (ARBIS/RGPRI) – organized by the medical colleges

Start-up for radiological departments

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Conclusion

Safety culture is an organizational **culture**

- Awareness and implementation of justification
- Optimization attitude
- Incident reporting, analysis and follow-up
- Audit as a tool for review and improvement

Take home questions

- What is the typical dose that **your patients** receive for a certain procedure?
- Are you **aware** of the related **risks**?
- How does this dose relate to **typical doses** for this procedure?
- What are the **possible incidents** that could happen in your department and what are the barriers put on to **avoid** them?
- Where could you still **improve**?