Global Scenario and Challenges in Medical Radiation Protection

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IAEA

Atoms for Peace: The First Half Century
1957–2007

Global Scenario (UNSCEAR)*

- **3.6 billion medical X ray procedures/ year**
- **About 35 million nuclear medicine examinations**
- **About 5 million patients radiotherapy treatments**

*United Nations Scientific Committee on Effects of Atomic Radiation Report 2008

Global Scenario

- 3.6 billion medical X ray procedures/year
- About 35 million nuclear medicine examinations
- About 5 million patients radiotherapy treatments

Challenge!!!!!

Desert

Lack of

- **Diagnostic Medical Physicist**
- **Dosimetry tools**
- **Access to journals**

- **Equipment not having dose display**
- **Staff not knowing what dose displays mean**

How will you meet this challenge?

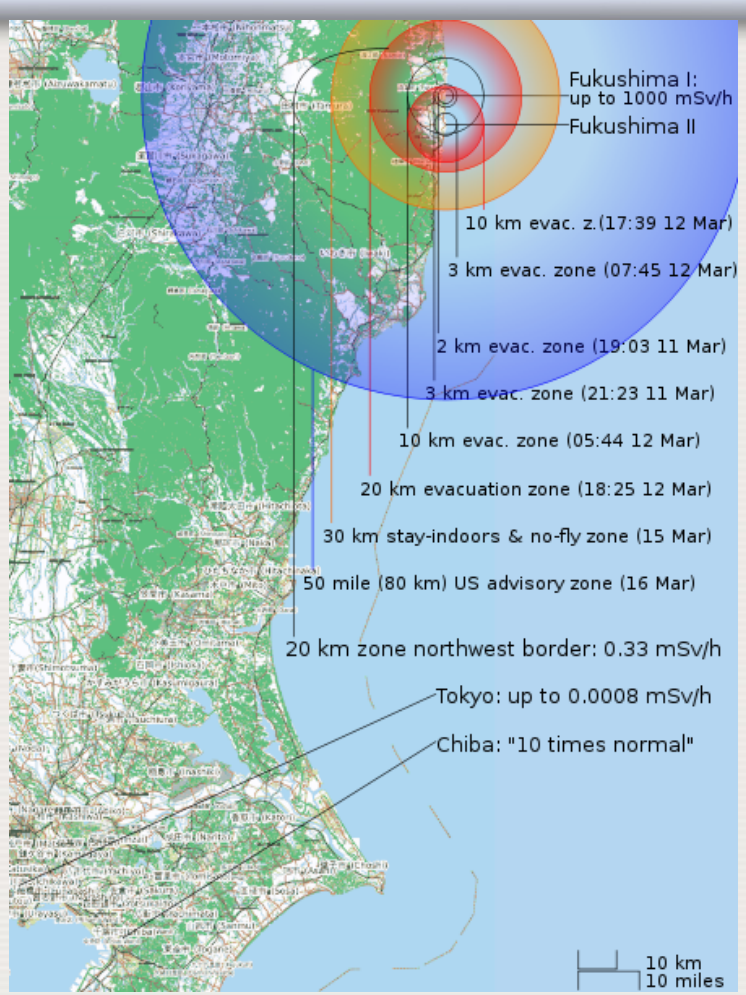
Process

- Initially >>>>Knowledge
- Subsequently tools
  - For knowledge (training material)
  - Information dissemination (Website)
  - Networks
- Finally>>Actual demonstration of status of
  - patient protection
  - Staff protection

Radiation Risks in Perspective: Rationalizing

Bitter Pill

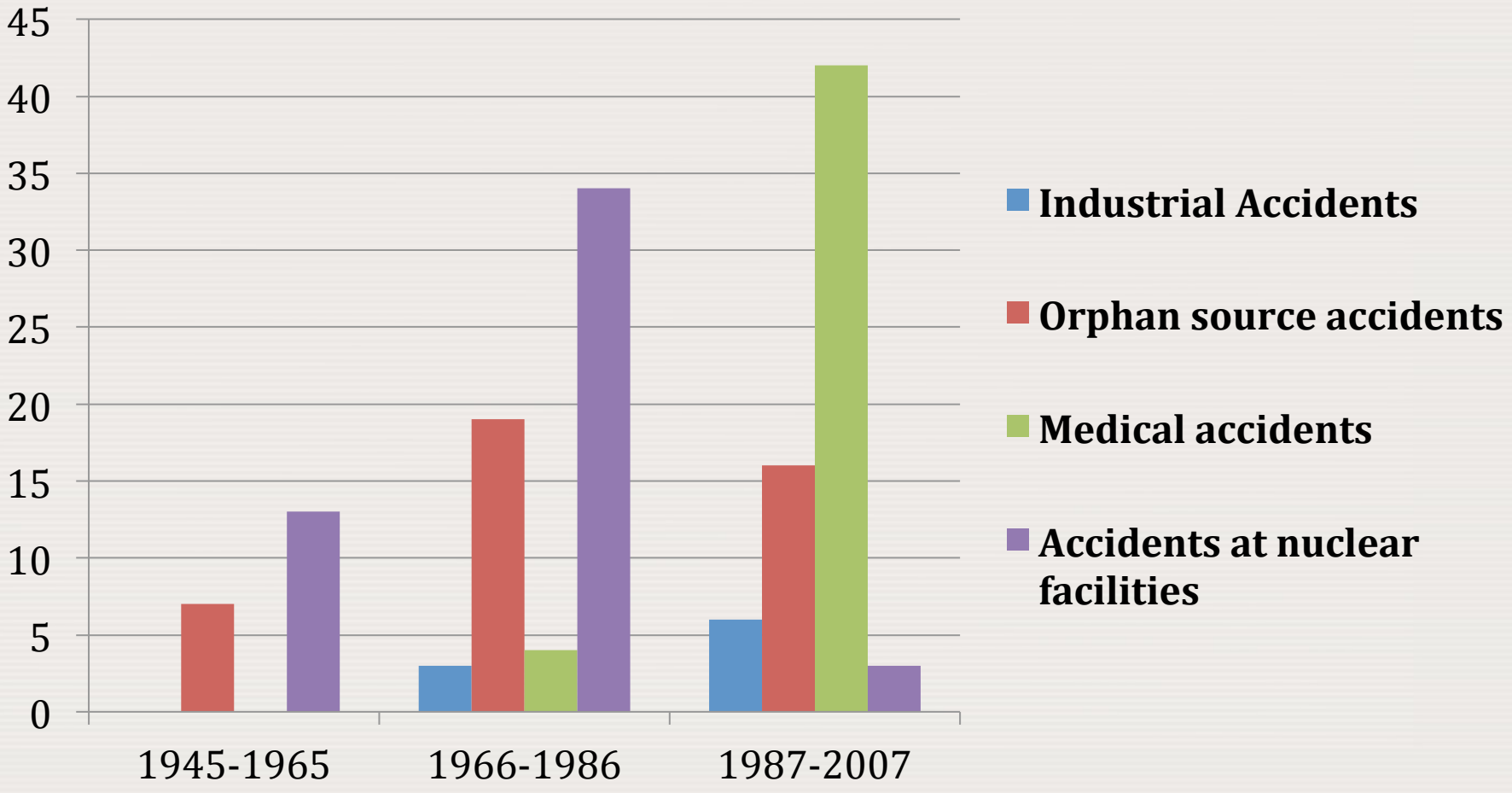
Fukushima



How many deaths because of radiation???


zero

Deaths (UNSCEAR)*



*United Nations Scientific Committee on Effects of Atomic Radiation

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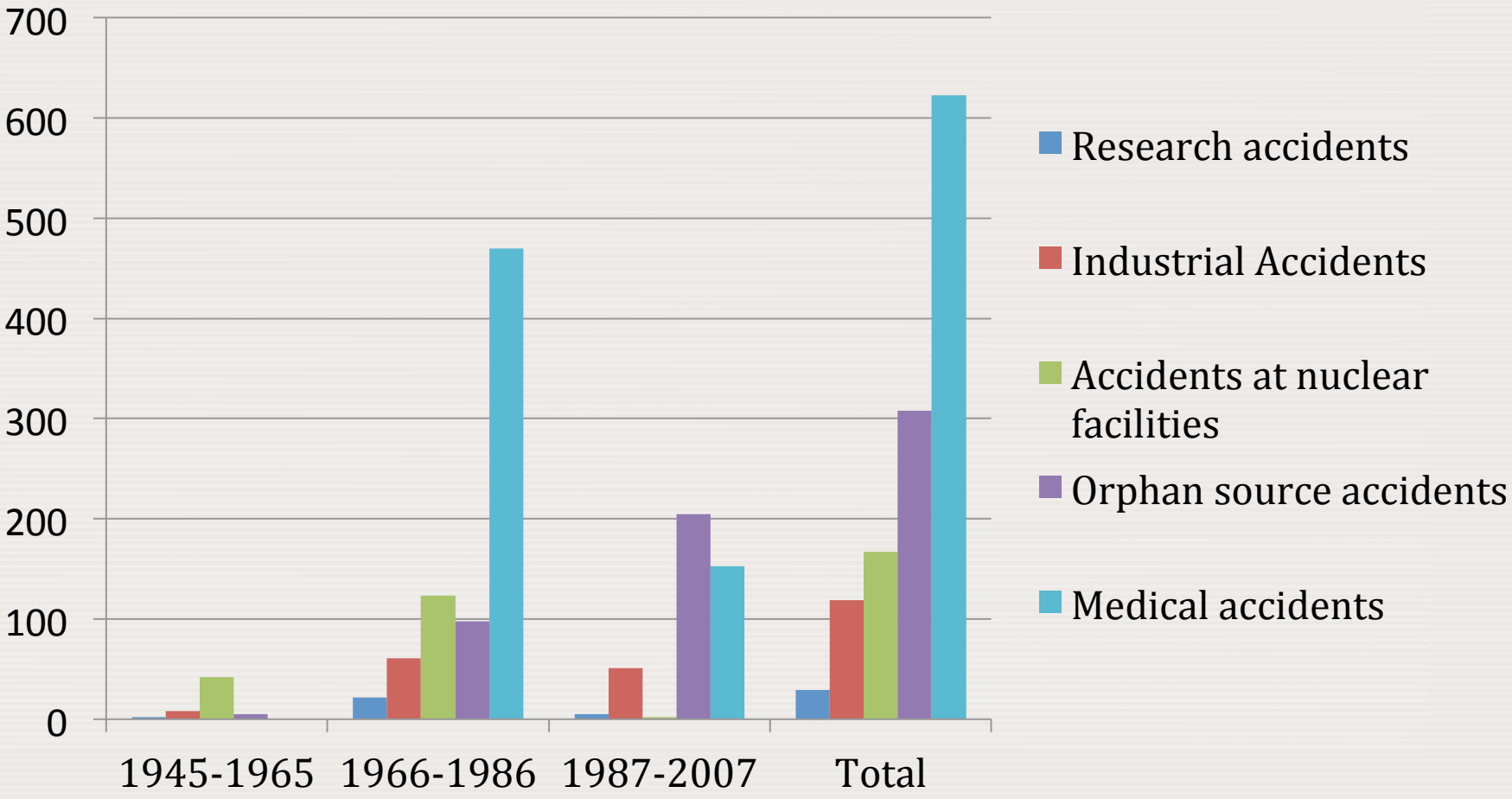
Early Acute Health Effects



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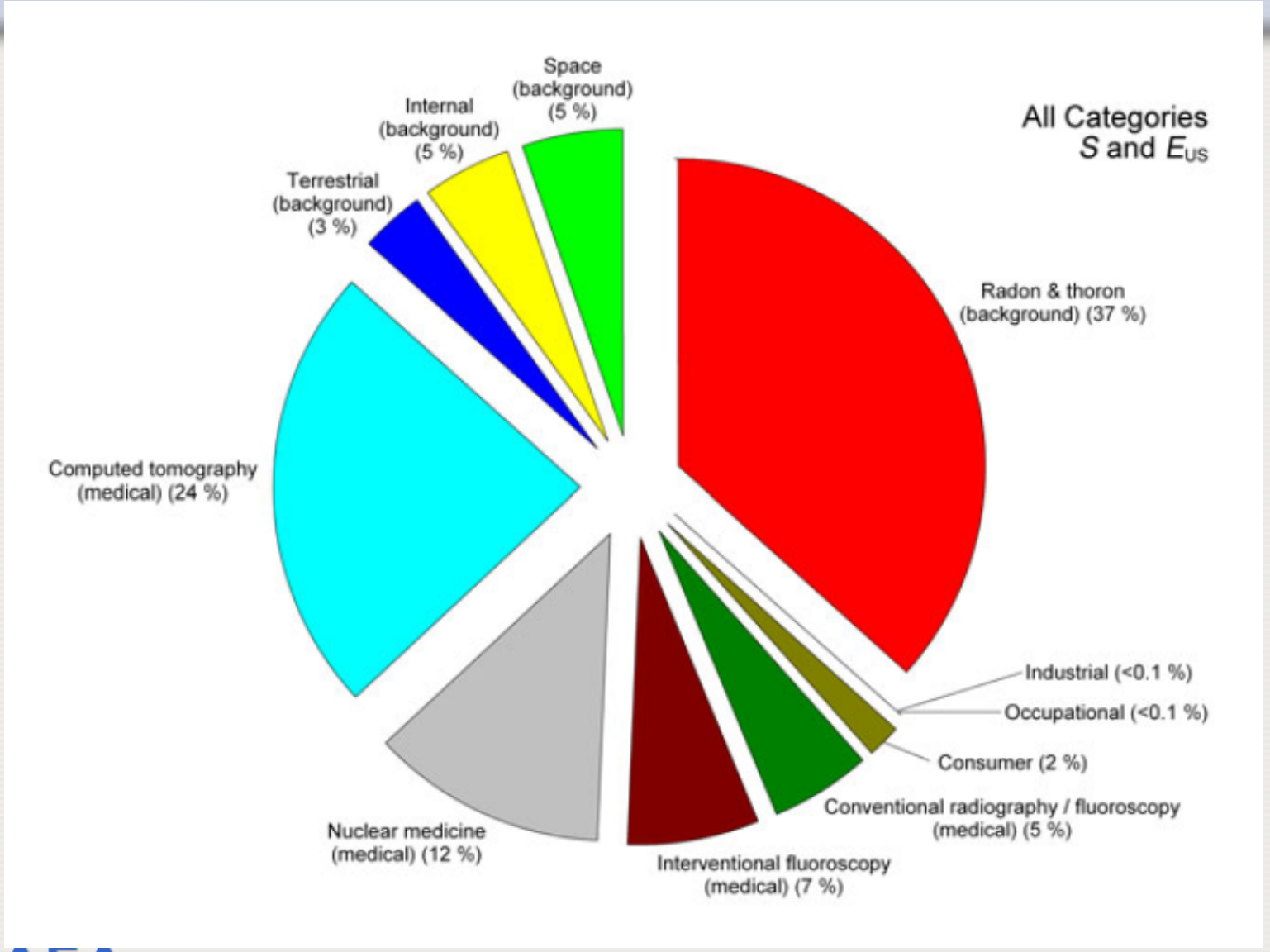
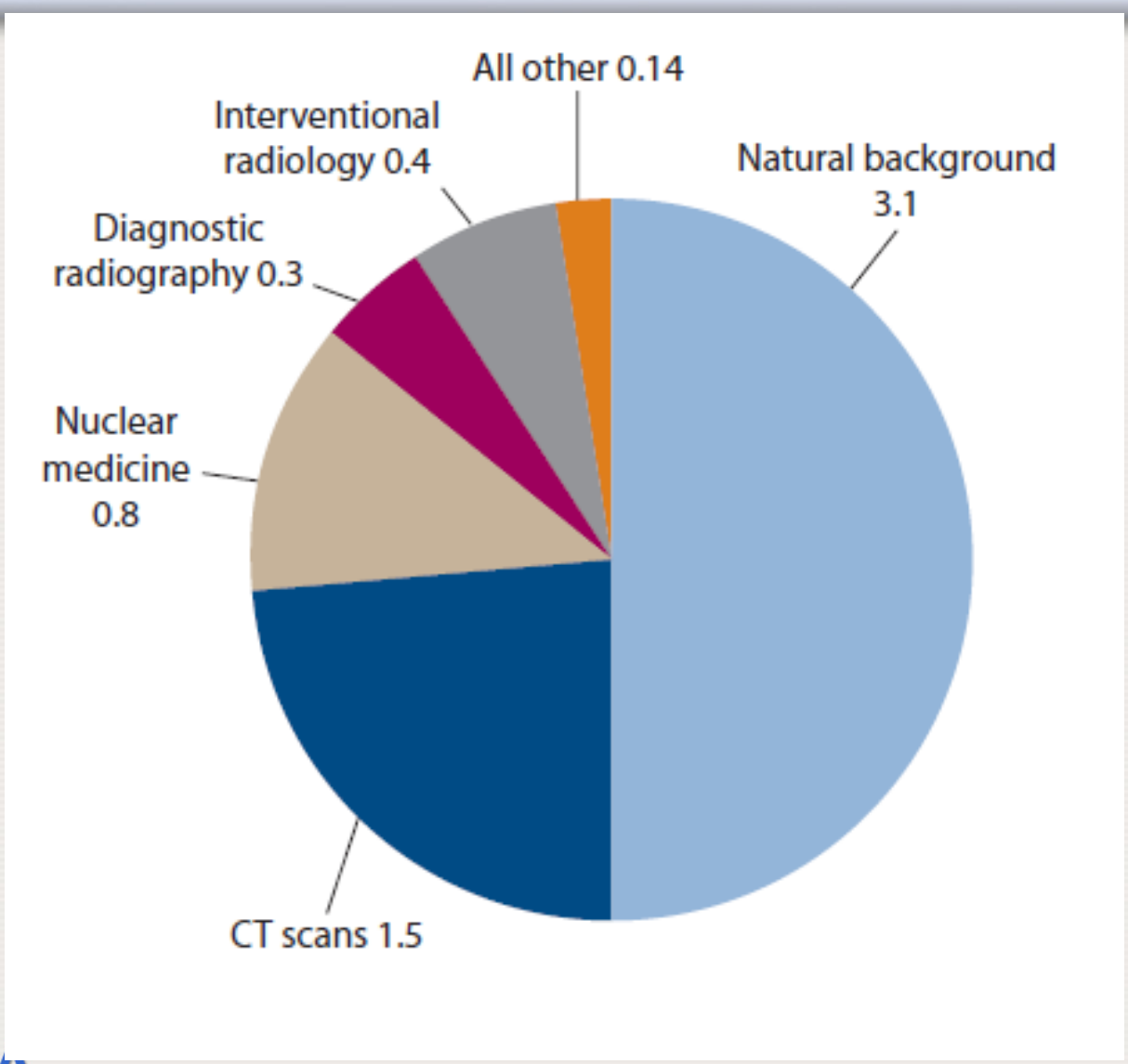

All Categories
S and E_{US}
Space (background) (5 %)
Internal (background) (5 %)
Terrestrial (background) (3 %)
Radon & thoron (background) (37 %)
Computed tomography (medical) (24 %)
Industrial (<0.1 %)
Occupational (<0.1 %)
Consumer (2 %)
Conventional radiography / fluoroscopy (medical) (5 %)
Nuclear medicine (medical) (12 %)
Interventional fluoroscopy (medical) (7 %)

UNSCEAR 2008 (US Data)



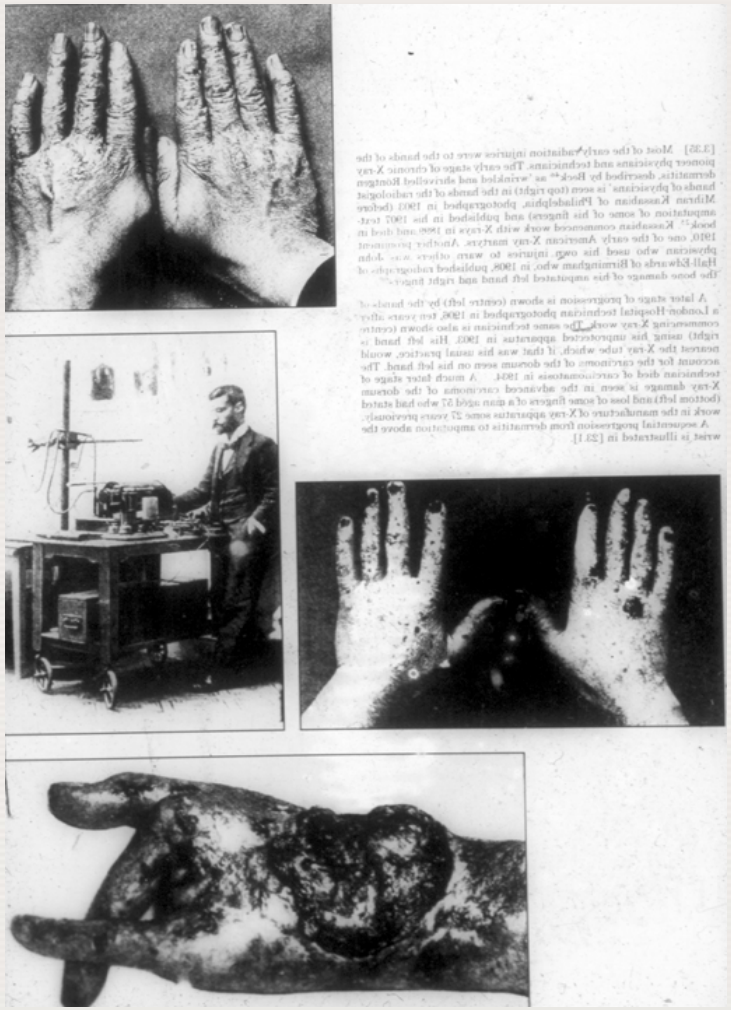
Carry Home Points

1. Deaths & acute health effects from medical accidents are significant
2. Medical exposure: largest source of radiation exposure

Member States' Attitude

- QC tools
- Training course
- Fellowships, SV, Expert mission
- No results to show….
- Unpopular stand to ask them to show results and demonstrate change

Almost a thing of past for staff in medical



Color??

But this is IN

Patients are having these injuries

Where do the injuries occur in interventional procedures?

- Severe injuries have occurred from the neck to the buttocks
- Sometimes anteriorly &
- On the side of torso

non-cardiac procedures

Current situation

A case of radiation induced skin injury is filed in US courts every 4 to 6 weeks currently, primarily from interventional procedures

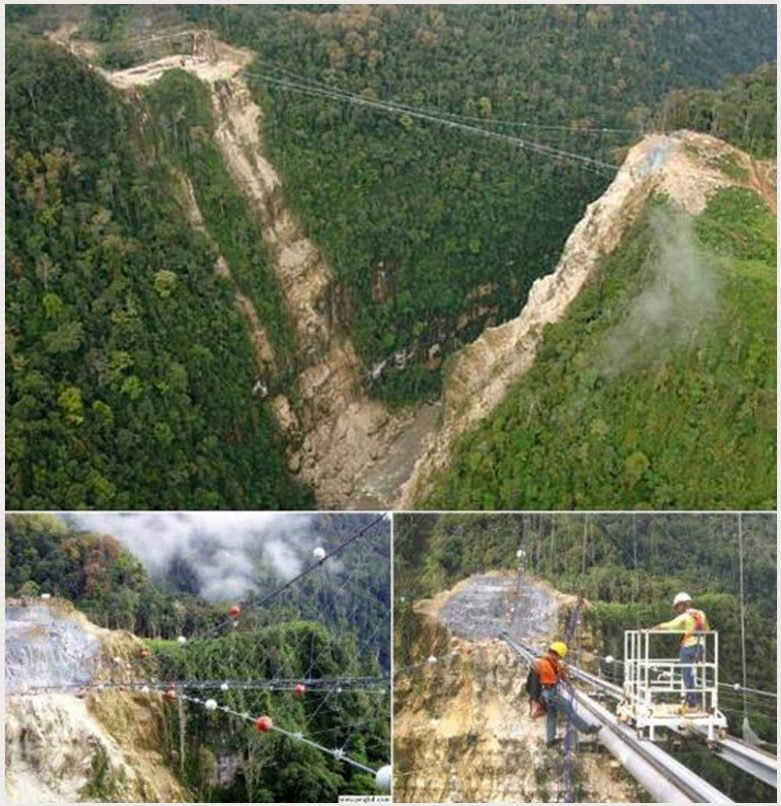
≈10 cases/year

Carry Home Points

1. Deaths & acute health effects from medical accidents are significant
2. Medical exposure: largest source of radiation exposure
3. Overexposure are happening in recent years

One has to decide what one wants to do?

- Go by wishes of people in-house and Member States
- CHANGE



Change

Change in a attitude of people in-house

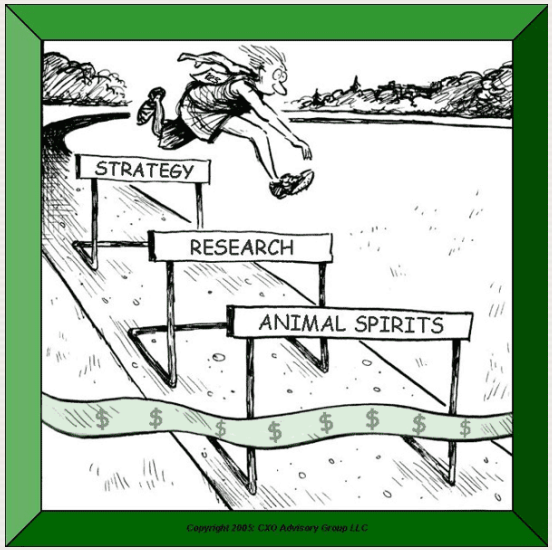
Change in attitude of people in Member States

Change in situation

Crossing Thresholds in-house

Myth (2001)

- Why we need to be concerned about radiation protection of patients- the risks are tiny!!
- In nuclear reactors the risks are very high.



In-house (Myth)

- **Hardly anyone can make that statement anymore**
- **Common feeling (From Top to all levels down the line in IAEA)-that medical exposure is the largest contributor to radiation exposure of population**

Slight set-back because of Fukushima

Carry Home Points

1. Deaths & acute health effects from medical accidents are significant
2. Medical exposure: largest source of radiation exposure
3. Overexposure are happening in recent years
4. Accept to change

Change No. 1 (In-house)

- **That medical exposure is an important area**

Changing scenario

Previously: You have to work whole life with radiation, whereas the patient may undergo procedure only few times

1957–2007

Now

Cumulative life time dose

Change No. 2 (In-house)

- That patient protection is more important than staff protection

Myth (2001)

- If regulations are in place the INTRASTRUCTURE is there, safety is assured

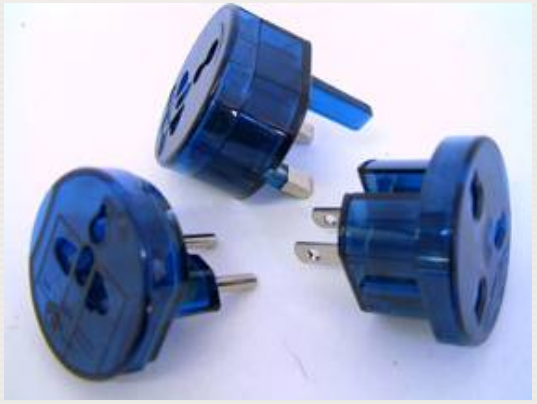
Change No. 3 (In-house)

- **Top down approach is not adequate**

More hurdles

- **Our job is to establish radiation safety standards**

- **Journal publish-university**



Some patients undergoing Tens of CT scan in few years resulting in >100 mSv

Long Term risk of Cancer

CBSNEWS HEALTHWATCH

Nov. 28, 2007

Are CT Scans Worth The Cancer Risk?

Study Warns Scans May Cause 2% Of All U.S. Cancers In Coming Decades

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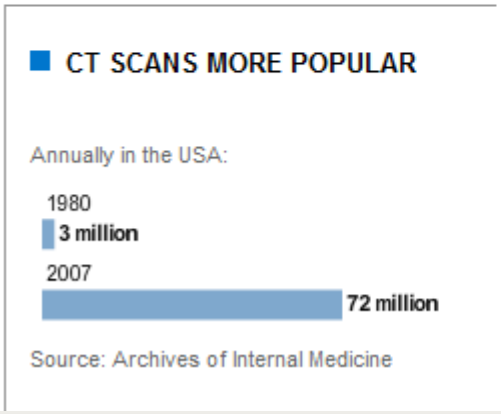
Radiation from CT scans linked to cancers, deaths

Updated 12/14/2009 8:41 PM | Comments 187 | Recommend 63 E-mail | Save | Print | Reprints & Permissions | RSS



By Liz Szabo, USA TODAY

CT scans deliver far more radiation than has been believed and may contribute to 29,000 new cancers each year, along with 14,500 deaths, suggest two studies in today's *Archives of Internal Medicine*. One study, led by the National Cancer Institute's Amy Berrington de Gonzalez, used existing exposure data to estimate how many cancers might be caused by CT scans.

Another study in the journal suggests the problem may even be worse. In that study,

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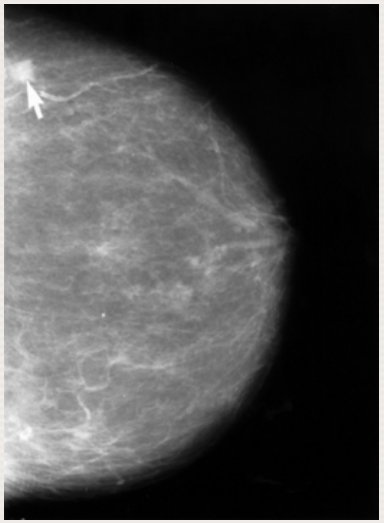
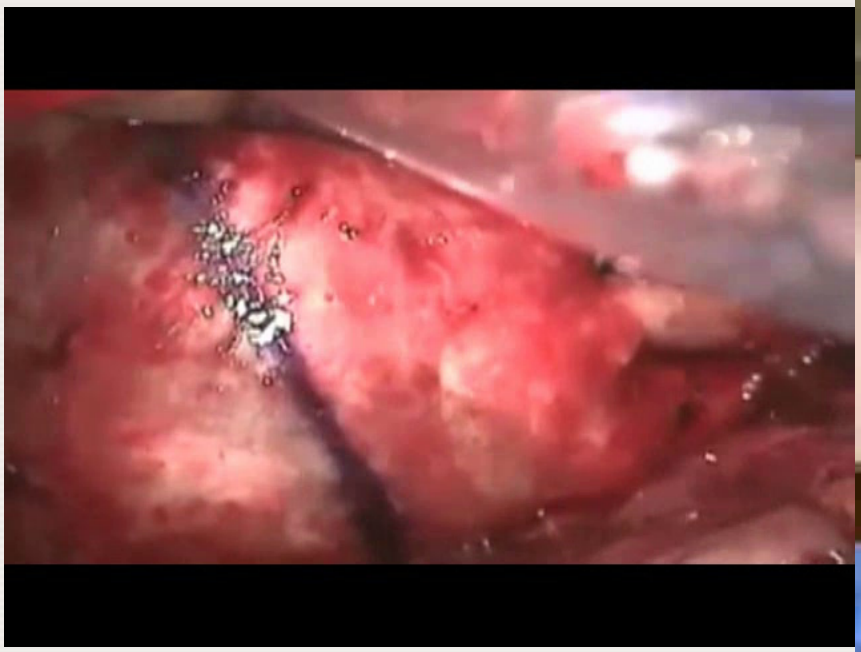
Study: CT scans can reduce lung cancer deaths by 20%

Updated 11/5/2010 2:07 PM | Comments 79 | Recommend 13 E-mail | Save | Print | Reprints & Permissions |

- In Europe and US, the mortality associated with breast cancer has **decreased by 20-30%** during a nearly 20-year period, dating from late 1980's. Reason early detection by mammography and effective treatment






ADMITTING

Objective of Radiation Protection

Benefits should outweigh the risk

and **they invariably do** when radiation protection is practiced

Be Aware!!

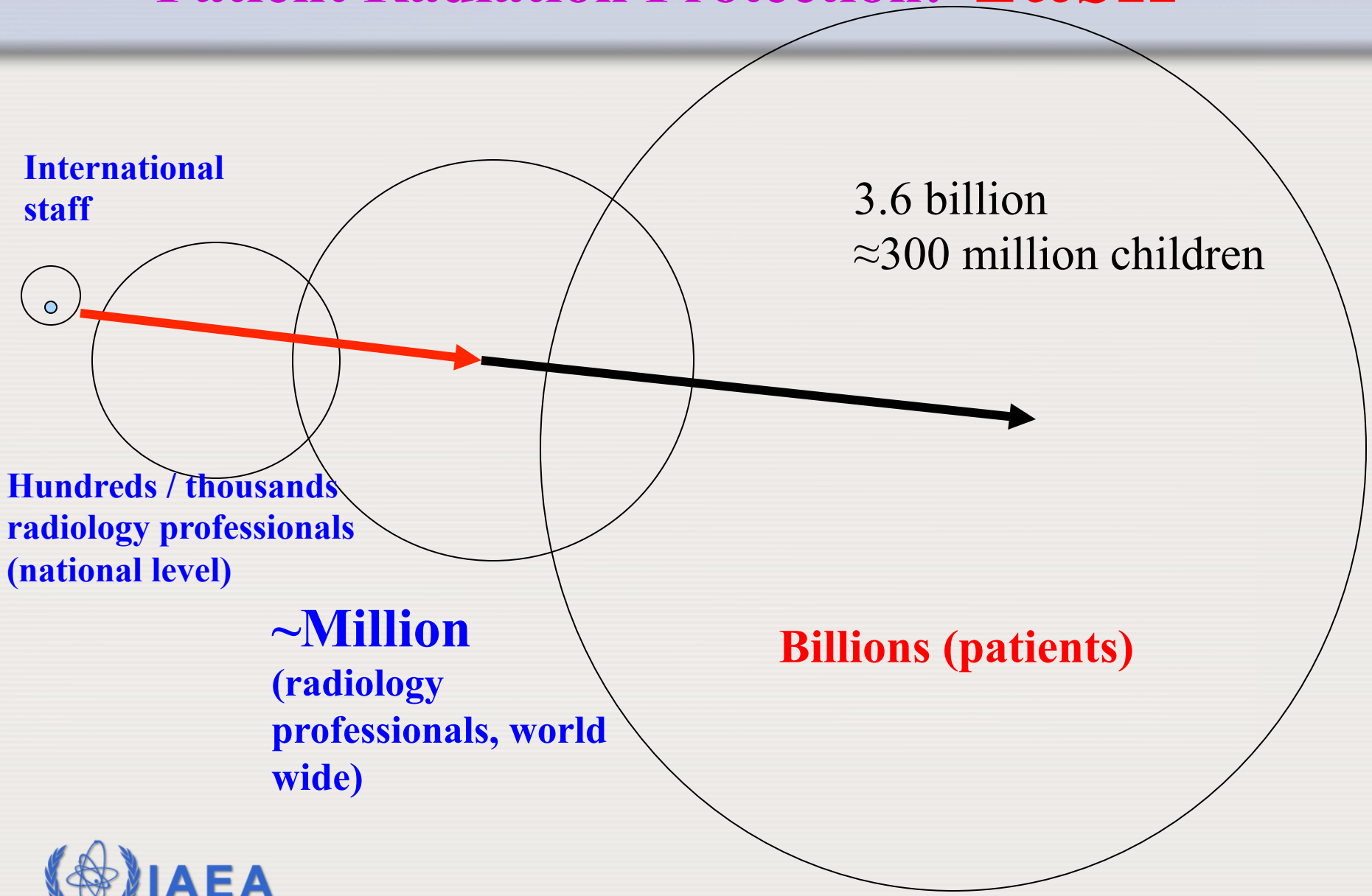
Radiation protection does not imply reducing usage. It is aimed at reducing

- **INAPPROPRITE usage and**
- **Unnecessary radiation dose**

Carry Home Points

1. Deaths & acute health effects from medical accidents are significant
2. Medical exposure: largest source of radiation exposure
3. Overexposure are happening in recent years
4. Accept to Change
5. **Benefits-risk considerations**

Patient Radiation Protection: Task



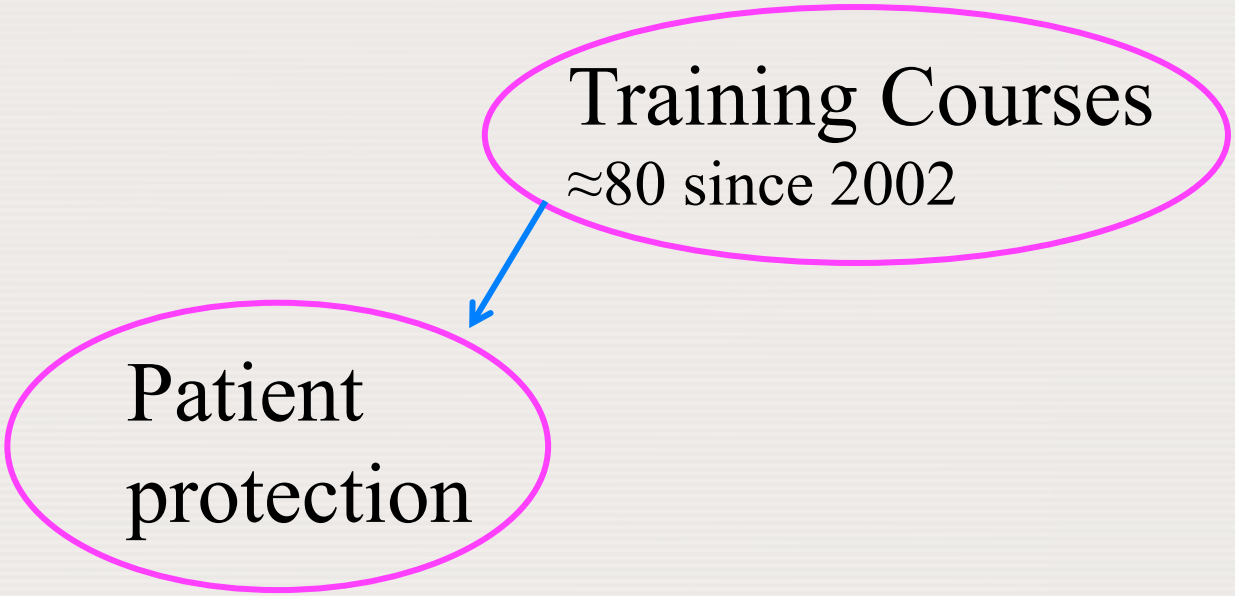
Training

Training courses organized

Regional Training courses

Radiation Protection in	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002
Diagnostic & Interventional Radiology including workshop on dose management	USA Qatar Finland Ghana* Algeria* Peru	Algeria Kenya Italy	Brazil	Italy Serbia	Cost Rica Italy	Kuwait Thailand	Kuwait	Kenya Kuwait	India Kuwait Slovenia	France Kenya Kuwait Malaysia
Nuclear Medicine						UAE		Saudi Arabia	Turkey	Albania Philippines
Radiotherapy/Prevention of Accidental Exposure in Radiotherapy			Chile		Thailand		Uruguay	Ecuador Malaysia Sudan Turkey	France Guatemala Jordan Korea	Chile Cuba Panama Turkey
Medicine (Trainer's Workshop)			Estonia					Argentina Thailand	Argentina Turkey	Prague
Cardiology	Cuba	Chile	Philippines	Armenia	Cost Rica	Chile Ethiopia Iran Thailand	Singapore	Vienna		
Radiation Protection for non-cardiologists, non-radiologists using Fluoroscopy				Bulgaria Uruguay	UAE	New Zealand				
Hybrid Imaging (PET/CT, SPECT/CT)	Uruguay	Slovenia	Singapore Nicaragua							

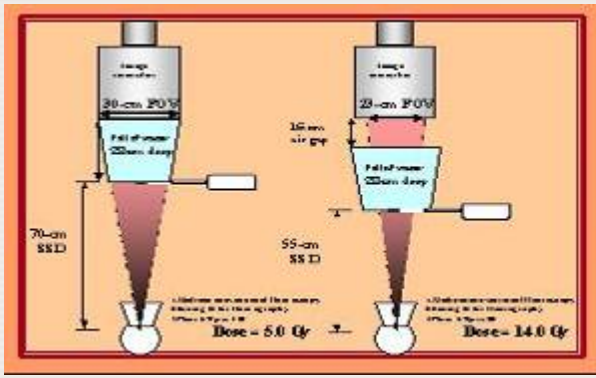
Medical Radiation Protection

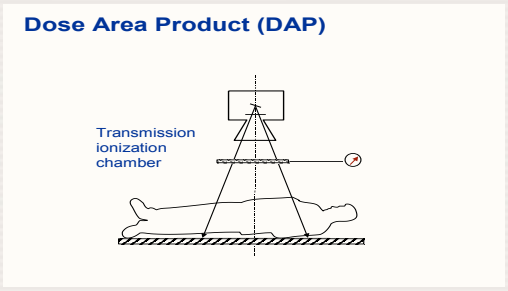


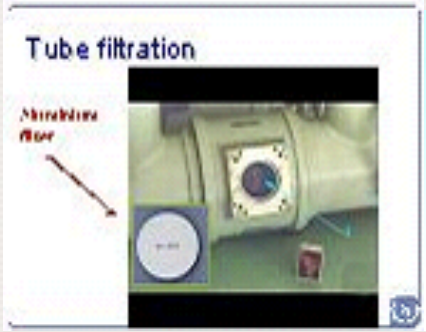
Approaches

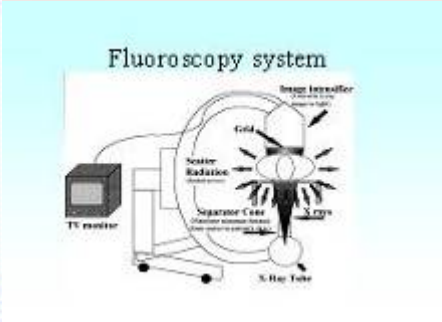
- **Train people**
- **No idea if it is making a change in situation**

Approved Training Package
IAEA Training Material on Radiation Protection in Diagnostic and Interventional Radiology









in collaboration with

IAEA
Atoms for Peace: The First Half Century
1957–2007

Version: January 2005

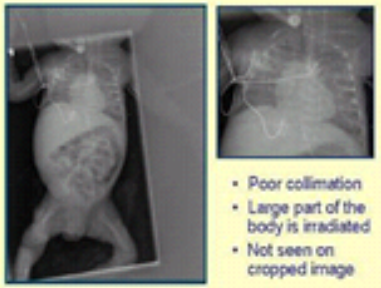
Adding value & credibility

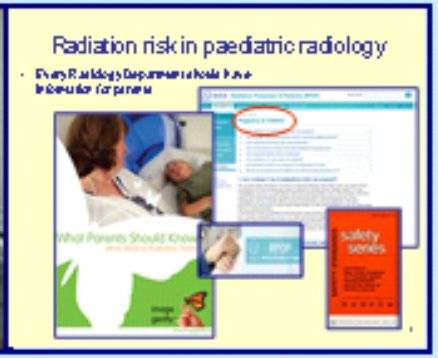
Home » Training » Free Material

Diagnostic and Interventional Radiology

Training material developed in collaboration with
World Health Organization (WHO)
Pan American Health Organization (PAHO)
International Labour Organization (ILO)
International Society of Radiology (ISR)
International Organization for Medical Physics (IOMP)
International Society of Radiographers and Radiological Technologists (ISRRT)

IAEA Training Material on Radiation Protection of Children





in collaboration with image gently

Version: November 2010

Free Material

- Diagnostic and Interventional Radiology →
- Radiotherapy →
- Nuclear Medicine →
- Prevention of Accidental Exposure in Radiotherapy →
- Cardiology →
- PET/CT →
- Paediatric Radiology →
- Digital Radiology →
- Doctors using fluoroscopy outside radiology (Urologists, Gastroenterologists, Orthopaedic surgeons etc.) →

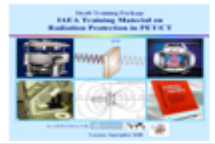
Русский

40,000 downloads/year

Medical Radiation Protection

Training Courses
≈80 since 2002

Patient protection



Free Material

Approaches

- Making training material available free
- High downloads, good apperceptions from personal interactions, but still
- No idea if it is making a change in patient protection
- ----------

1. Assessing patient doses and image quality
2. Comparing with Standards
3. Improving

Our recent study- Pediatric CT

Armenia (1),
Belarus (1),
Bosnia & Herz (3)
Brazil (5),
Bulgaria (12),
China (3),
Costa Rica (1),
Croatia (3),
Czech Republic (6),
Estonia (2),
Indonesia (1),

Iran (10),
Israel (7),
Kuwait (5),
Lebanon (6),
Lithuania (3),
Malaysia (5),
Malta (1),
Mexico (2),
Montenegro (1),
Moldova (5),
Myanmar (1),

Oman (1),
Pakistan (5),
Paraguay (3),
Peru (1),
Poland (1),
Qatar (1),
Serbia (3),
Singapore (1),
Slovakia (4),
Slovenia (1),
Sri Lanka (2)

Sudan (3),
Syria (8),
Tanzania (3),
Thailand (2),
The Former Yugoslavia Republic (FYR) of Macedonia (5),
United Arab Emirates UAE (15).

40 Less resourced countries

AJR FOCUS ON:

IAEA Survey of Pediatric CT Practice in 40 Countries in Asia, Europe, Latin America, and Africa: Part I, Frequency and Appropriateness

Jenia Vassileva[1]
Madan M. Rehani[2]
See end of article for complete author list

OBJECTIVE. The purpose of this study was to assess the frequency of pediatric CT in 40 less-resourced countries and to determine the level of appropriateness in CT use.

MATERIALS AND METHODS. Data on the increase in the number of CT examinations during 2007 and 2009 and appropriate use of CT examinations were collected, using standard forms, from 146 CT facilities at 126 hospitals.

Eur Radiol
DOI 10.1007/s00330-012-2639-3

COMPUTED TOMOGRAPHY

IAEA survey of paediatric computed tomography practice in 40 countries in Asia, Europe, Latin America and Africa: procedures and protocols

Jenia Vassileva · Madan M. Rehani · Kimberly Applegate · Nada A. Ahmed · Humoud Al-Dhuhli · Huda M. Al-Naemi

First ever study of this kind

Findings from these papers

- Modern MDCT available in 77%
- Dedicated CT protocols in 94%
- Protocols for some age groups not available 50%
- Indication based protocols used in 57%
- $CTDI_{vol}$ for head, chest in some facilities 2-5 times adults
- Up to 100 times variation in radiation dose

Radiation Protection Dosimetry Advance Access published August 17, 2009

Radiation Protection Dosimetry (2009), pp. 1–9 doi:10.1093/rpd/ncp144

PATIENT DOSES IN CT EXAMINATIONS IN 18 COUNTRIES: INITIAL RESULTS FROM INTERNATIONAL ATOMIC ENERGY AGENCY PROJECTS

W. E. Muhogora[1], N. A. Ahmed[2], A. Beganovic[3], A. Benider[4], O. Ciraj-Bjelac[5], V. Gershan[6], E. Gershkevitsh[7], E. Grupetta[8], M. H. Kharita[9], N. Manatrakul[10], M. Milakovic[11], K. Ohno[12], L. Ben Omrane[13], J. Ptacek[14], C. Schandorf[15], M. S. Shabaan[16], D. Stoyanov[17], N. Toutaoui[18], J. S. Wambani[19] and M. M. Rehani[20,*]

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Radiation Protection Dosimetry Advance Access published February 11, 2010

Radiation Protection Dosimetry (2010), pp. 1–10 doi:10.1093/rpd/ncq015

PAEDIATRIC CT EXAMINATIONS IN 19 DEVELOPING COUNTRIES: FREQUENCY AND RADIATION DOSE

W. E. Muhogora[1], N. A. Ahmed[2], J. S. AlSuwaidi[3], A. Beganovic[4], O. Ciraj-Bjelac[5], V. Gershan[6], E. Gershkevitsh[7], E. Grupetta[8], M. H. Kharita[9], N. Manatrakul[10], B. Maroufi[11], M. Milakovic[12], K. Ohno[13], L. Ben Omrane[14], J. Ptacek[15], C. Schandorf[16], M. S. Shaaban[17], N. Toutaoui[18], D. Sakkas[19], J. S. Wambani[20] and M. M. Rehani[21,*]

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AJR June 2008

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Keywords: patient doses, quality assurance, radiation protection, radiation safety, radiography

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Patient Doses in Radiographic Examinations in 12 Countries in Asia, Africa, and Eastern Europe: Initial Results from IAEA Projects

OBJECTIVE. The purpose of this study was to survey image quality and the entrance surface air kerma for patients in radiographic examinations and to perform comparisons with diagnostic reference levels.

SUBJECTS AND METHODS. In this multinational prospective study, image quality and patient radiation doses were surveyed in 12 countries in Africa, Asia, and Eastern Europe, covering 45 hospitals. The rate of unsatisfactory images and image quality grade were noted, and causes for poor image quality were investigated. The entrance surface doses for adult patients were determined in terms of the entrance surface air kerma on the basis of X-ray tube output measurements and X-ray exposure parameters. Comparison of dose levels with diagnostic reference levels was performed.

RESULTS. The fraction of images rated as poor was as high as 53%. The image quality improved up to 16 percentage points in Africa, 13 in Asia, and 22 in Eastern Europe after implementation of a quality control (QC) program. Patient doses varied by a factor of up to 88, although the majority of doses were below diagnostic reference levels. The mean entrance surface air kerma values in mGy were 0.33 (chest, posteroanterior), 4.07 (lumbar spine, anteroposterior), 8.53 (lumbar spine, lateral), 3.64 (abdomen, anteroposterior), 3.68 (pelvis, anteroposterior), and

Plus 9 countries in Latin American region

Radiography- Optimization

- In all countries radiation doses (ESAK) within Reference Levels and thus not higher than those in developed countries
- Poor image quality (4 to 53%)
- Improvements achieved (QC)
  - 1.4 to 85% reduction in dose (ESAK)
  - 2 to 16 percent points reduction in poor quality images

X-rays Often Repeated for Patients in Developing Countries

IAEA Moves to Help Improve Quality of Medical Radiography

Staff Report Staff Report

Patients in developing countries often need to have X-ray examinations repeated so that doctors have the image quality they need for useful medical diagnosis, the IAEA is learning. The findings come from a survey involving thousands of patients in 45 hospitals and 12 countries of Africa, Asia and Eastern Europe.

"Poor image quality constitutes a major source of unnecessary radiation to patients in developing countries," emphasizes Dr. Madan Rehani of the IAEA Division of Radiation, Waste and Transport Safety, which carried out the survey under technical cooperation (TC) projects of the IAEA.

- **First multi-national scientifically planned study of this kind**
- **What are problems pertaining dose & image quality rather than equipment testing (QC)**

DIRECTION of Work- Radiography

1. Assessing how safe are patients in radiological examinations ✓
2. Comparing with Standards ✓
3. Taking actions where necessary ✓
4. Make patients safer ✓

How many have experience in documenting reduction in patient doses?

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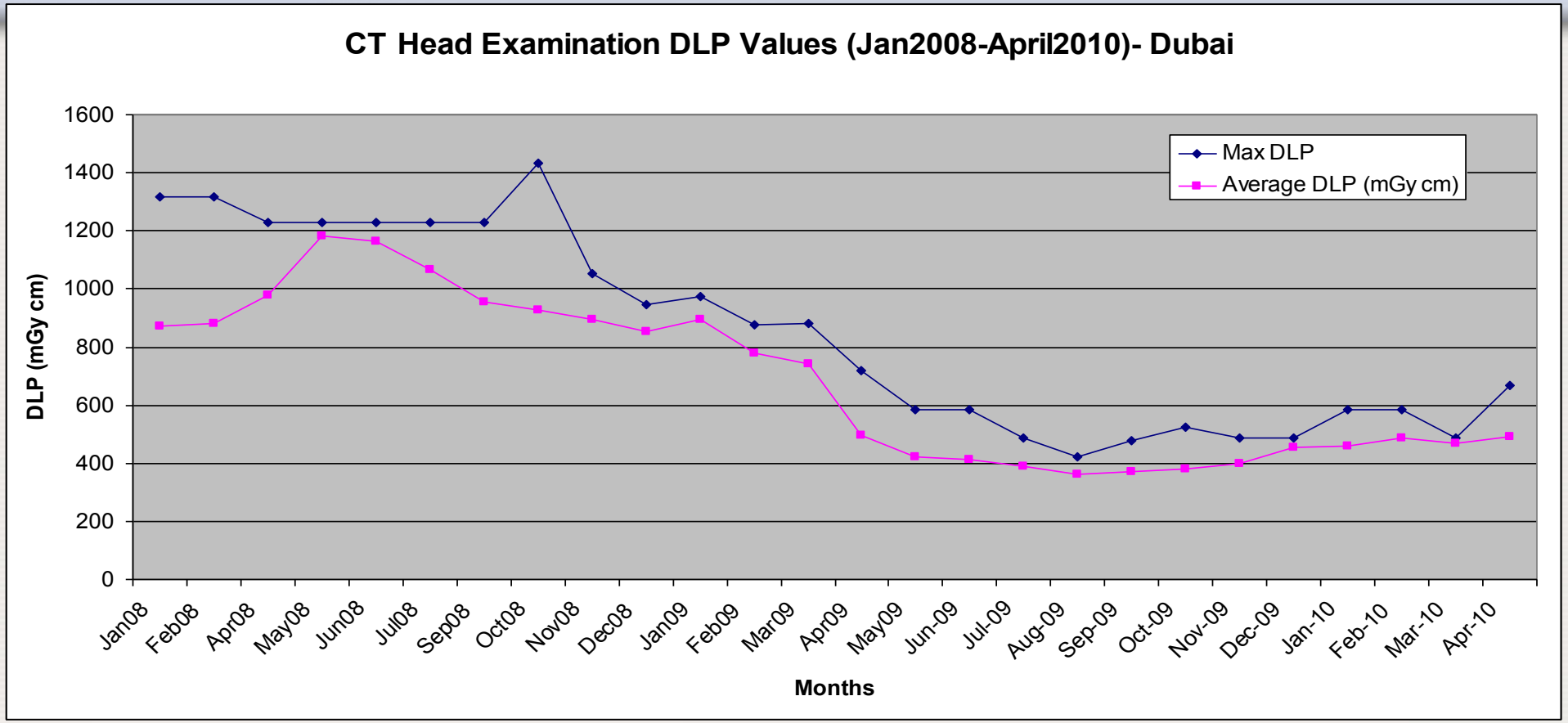
1957–2007

How many have experience in documenting impact of optimization WITH TIME???

Brain CT- Adults, UAE (Dubai)



How CT Dose has changed over period

Dose management actions following awareness, review of DLP values and analysis of causes when values are high and management in following patients thus increasing awareness among staff on regular basis

Carry Home Points

1. Deaths & acute health effects from medical accidents are significant
2. Medical exposure: largest source of radiation exposure
3. Overexposure are happening in recent years
4. Accept to Change
5. Benefits-risk considerations
6. **Choosing a right DIRECTION and pursuing it till results are achieved at grass root level**

AJR August 2009

Angioplasty

Virginia Tsapaki[1]
Nada A. Ahmed[2]
Jamila Salem AlSuwaidi[3]
Adnan Beganovic[4]
Abdelkader Benider[5]
Latifa BenOmrane[6]
Rada Borisova[7]
Sotirios Economides[8]
Leila El-Nachef[9]
Dario Faj[10]
Ashot Hovhannesyan[11]
Mohammad Hassan Kharita[12]
Nadia Khelassi-Toutaoui[13]
Nisakorn Manatrakul[14]
Ilkhom Mirsaidov[15]
Mohamed Shaaban[16]
Ion Ursulean[17]
Jeska Sidika Wambani[18]
Areesha Zaman[19]
Julius Ziliukas[20]
Dejan Žontar[21]
Madan M. Rehani[22]

Radiation Exposure to Patients During Interventional Procedures in 20 Countries: Initial IAEA Project Results

OBJECTIVE. The purpose of our study was to investigate the level of radiation protection of patients and staff during interventional procedures in 20 countries of Africa, Asia, and Europe.

SUBJECTS AND METHODS. In a multinational prospective study, information on radiation protection tools, peak skin dose (PSD), and kerma–area product (KAP) was provided by 55 hospitals in 20 mainly developing countries (nine mostly in Eastern Europe, five in Africa, and six in Asia).

RESULTS. Nearly 40% of the interventional rooms had an annual workload of more than 2,000 patients. It is remarkable that the workload of pediatric interventional procedures can reach the levels of adult procedures even in developing countries. About 30% of participating countries have shown a 100% increase in workload in 3 years. Lead aprons are used in all participating rooms. Even though KAP was available in almost half of the facilities, none had experience in its use. One hundred of 505 patients monitored for PSD (20%) were above the 2-Gy threshold for deterministic effects.

CONCLUSION. Interventional procedures are increasing in developing countries, not only for adults but also for pediatric patients. The situation with respect to staff protection is considered generally acceptable, but this is not the case for patient protection. Many patients exceeded the dose threshold for erythema. A substantial number (62%) of percutaneous transluminal coronary angioplasty procedures performed in developing countries in this study are above the currently known dose reference level and thus could be optimized. Therefore, this study has significance in introducing the concept of patient dose estimation and dose management.

Keywords: developing countries, IAEA activities, interventional procedures, patient safety, percutaneous transluminal coronary angioplasty (PTCA), radiation exposure, radiation safety, staff safety

DOI:10.2214/AJR.08.2115

Increasingly, interventional procedures are being performed us-

One of the most important factors in such cases is that doctors with no or minimal

heartwire | Comment | Send | Print | Share | Cite | Tweet this | Text size

IMAGING

Patient radiation exposure during interventional procedures needs greater attention

AUGUST 7, 2009 | Marlene Busko

Vienna, Austria - A study in developing countries reports that staff protection from radiation during interventional procedures such as PTCA is generally good, but patient radiation-dose optimization is neglected [1].

However, by participating in the study, "many professionals in so many countries now have a 'feel' for radiation dose and have become sensitized to dose assessment and dose management for the first time," study coordinator **Dr Madan M Rehani** (**International Atomic Energy Association** [IAEA], Vienna, Austria) told ***heartwire***.

To determine how safe patients and staff are during interventional procedures involving radiation, IAEA researchers examined 2004 to 2007 prospective data from 55 hospitals in one developed country (Greece) and 19 developing countries (eight in Eastern Europe, five in Africa, and six in Asia).

Only 57% of the facilities, however, were able to estimate patient radiation dose with a kerma-area-product (KAP) meter, and none had experience in its use. A total of 62% of coronary angioplasties had dose levels above current dose reference levels.

This shows that radiation protection for patients "needs to be higher on the agenda," Rehani said.

Clinical implications for all countries

This is a well-executed study with implications for practitioners in both the developed and developing world, **Dr Thomas C Gerber** (Mayo Clinic, Jacksonville, FL), who was not involved with the study, told **heartwire**.

"My general sense is that we don't emphasize radiation protection for personnel and patients sufficiently in our training of new physicians, at least in cardiology. More could be done. Many physicians perceive the medical physics training part as dry and boring, but I think it can be made interesting and engaging," he said.

Operators should have enough expertise to perform straightforward procedures with a radiation exposure that is "as low as reasonably achievable" and be able to perform complex procedures without an excessive increase in radiation exposure, Gerber noted.

We don't emphasize radiation protection for personnel and patients sufficiently in our training of new physicians, at least in cardiology. More could be done.

IAEA
Atoms for Peace: The First Half Century
1957–2007

Link to stories
Radiation exposure to patients during interventional procedures

http://www.arrs.org/Pressroom/info.cfm?prID=416

http://www.redorbit.com/news/science/1730905/patient_radiation_exposure_during_interventional_procedures_is_a_concern_for/index.html

http://www.diagnosticimaging.com/news/display/article/113619/1438852?cid=dienews-081809

http://www.sciencecentric.com/news/article.php?q=09080462-radiation-exposure-during-interventional-procedures-concern-some-developing-countries

http://www.unboundmedicine.com/medline/ebm/record/19620457/abstract/Radiation_exposure_to_patients_during_interventional_procedures_in_20_countries:_initial_IAEA_project_results

http://crosbi.znanstvenici.hr/prikazi-rad?chset=ASCII&lang=EN&rad=377326

http://www.physorg.com/news168525428.html

http://www.theheart.org/article/990729.do

http://www.medicaldeviceguru.com/showthread.php?p=8174

http://sciencecodex.com/radiation_exposure_during_interventional_procedures_a_concern_for_some_developing_countries

http://www.medicalnewstoday.com/articles/159747.php

http://www.sciencedaily.com/releases/2009/08/090803110954.htm

http://www.news-medical.net/news/20090803/Radiation-exposure-during-interventional-procedures-a-concern-for-some-developing-countries.aspx

Mammography

European Journal of Radiology

journal homepage: www.elsevier.com/locate/ejrad

Image quality and dose in mammography in 17 countries in Africa, Asia and Eastern Europe: Results from IAEA projects

Olivera Ciraj-Bjelac[a,1], Simona Avramova-Cholakova[b,2], Adnan Beganovic[c,3], Sotirios Economides[d,4], Dario Faj[e,5], Vesna Gershan[f,6], Edward Grupetta[g,7], M.H. Kharita[h,8], Milomir Milakovic[i,9], Constantin Milu[j,10], Wilbroad E. Muhogora[k,11], Pirunthavany Muthuvelu[l,12], Samuel Oola[m,13], Saeid Setayeshi[n,14], Cyril Schandorf[o,15], Ion Ursulean[p,16], Ivan R. Videnovic[q,17], Areesha Zaman[r,18], Julius Ziliukas[s,19], Madan M. Rehani[t,*]

European Journal of Radiology
Article in Press, Corrected Proof - Note to users

doi:10.1016/j.ejrad.2011.03.075 | How to Cite or Link Using DOI
Permissions & Reprints

Radiation protection of patients in diagnostic radiology: Status of practice in five Eastern-European countries, based on IAEA project

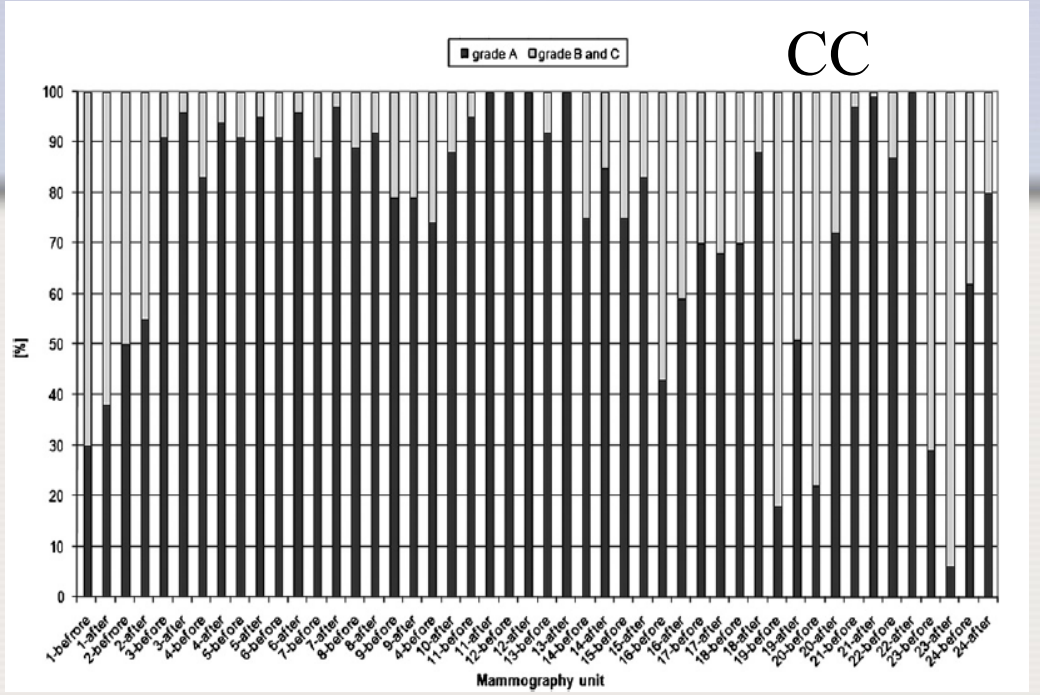
Olivera Ciraj-Bjelac[a, 1], Adnan Beganovic[b, 2], Dario Faj[c, 3], Vesna Gershan[d, 4], Sonja Ivanovic[e, 5], Ivan R. Videnovic[f, 6] and Madan M. Rehani[g,]

Image quality improvement

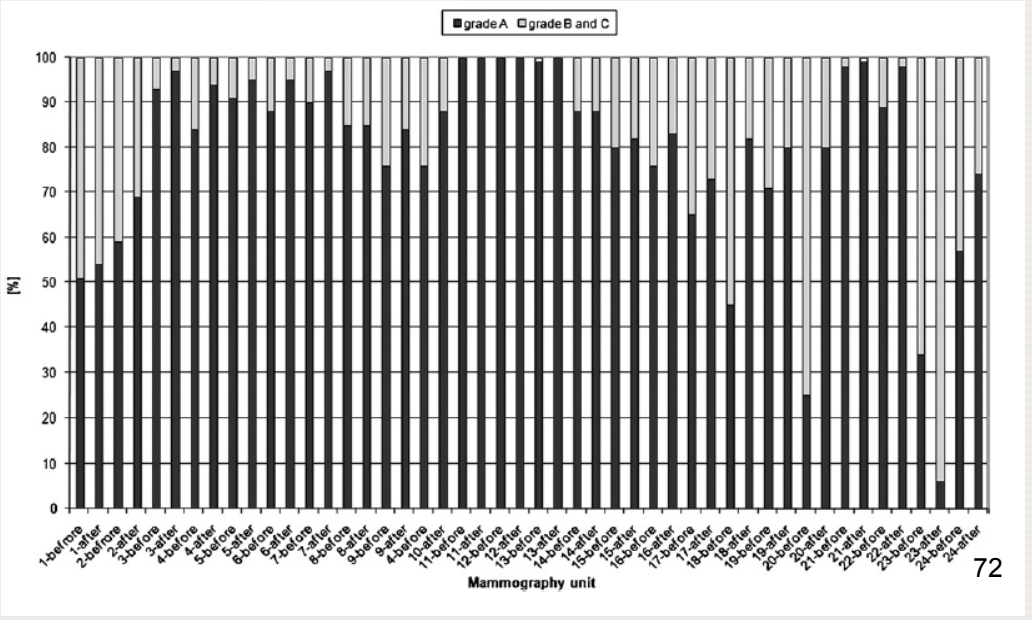
- Image quality improved by:
  - ***9 percentage for CC***
  - ***7 percentage points for MLO***

- Range: from a few percentage points to **more than 50 percentage points** in participating centres

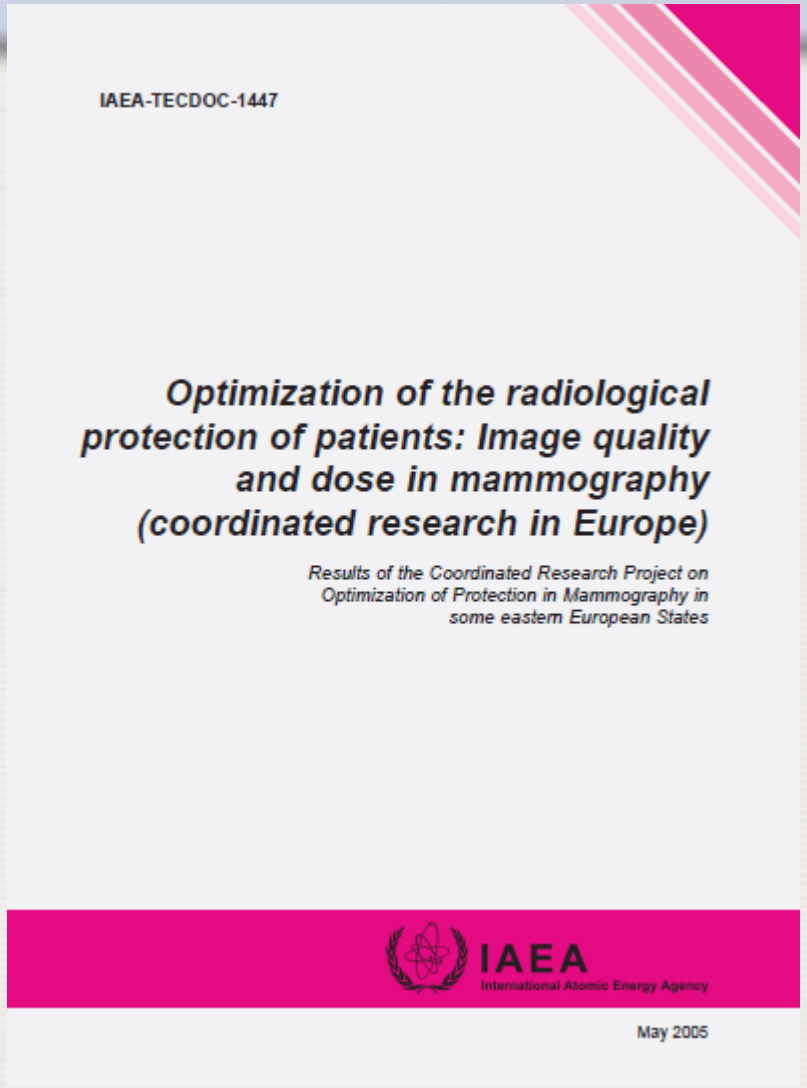
CC

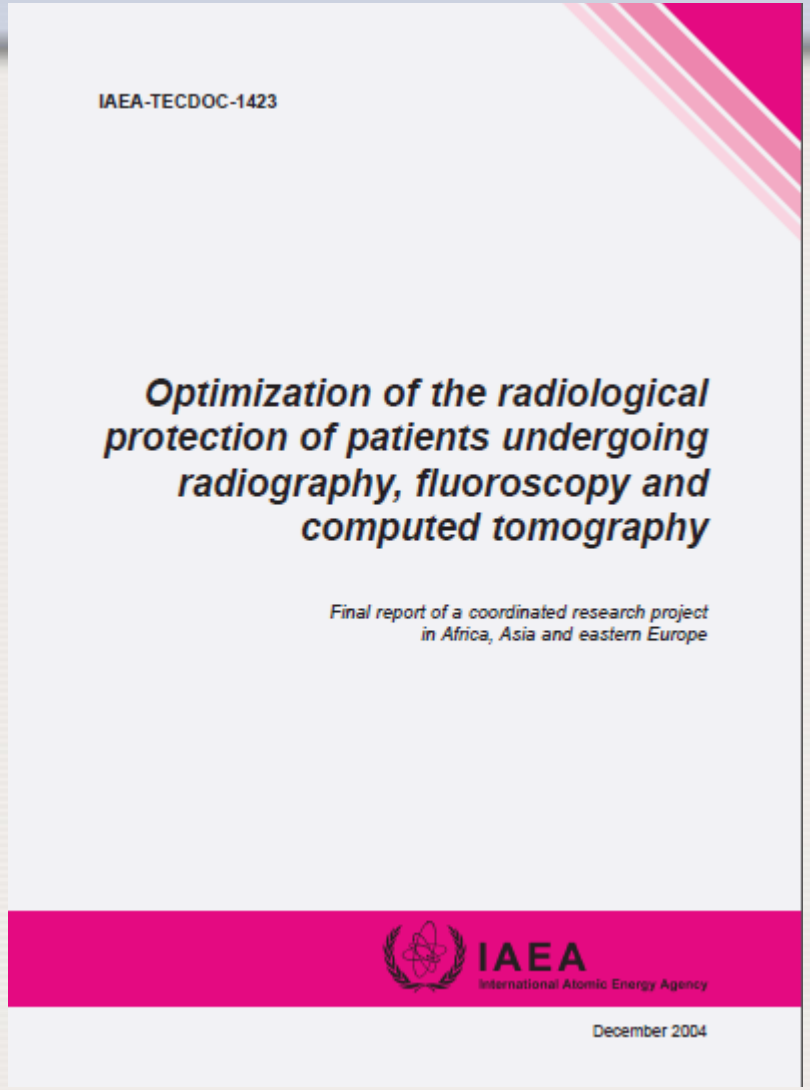


MLO



Free download http://rpop.iaea.org





Mammography

1. Assessing how safe are patients in radiological examinations ✓
2. Comparing with Standards ✓
3. Taking actions where necessary ✓
4. Make patients safer ✓

Europe (19 countries)

Country	CT	Interventional	Radiography	Mammography
Armenia	√	√	√	
Belarus	√			
Bosnia and Herzegovina	√	√	√	√
Bulgaria	√	√		√
Croatia	√	√	√	√
Cyprus	√			
Estonia	√			
FYROM	√		√	√
Greece		√		√
Czech Republic	√			
Lithuania	√	√		√
Malta	√			√
Moldova	√	√		√
Montenegro	√		√	
Romania				√
Poland	√			
Serbia	√		√	√
Slovakia	√			
Slovenia	√	√		

Africa

Country	CT	Interventional	Radiography	Mammography
Algeria	√	√		
Ghana	√		√	√
Congo			√	
Morocco	√	√		
Sudan	√	√	√	
Kenya	√	√		
Madagascar			√	
Tanzania	√		√	√
Tunisia	√	√		
Uganda				√
Zimbabwe			√	

Middle East

Country	CT	Interventional	Radiography	Mammography
Israel	√			
Kuwait	√	√		
Lebanon	√	√		
Oman	√			
Iran	√		√	√
Qatar	√			
Saudi Arabia			√	
Syria	√	√		√
UAE	√	√	√	

Asia

Country	CT	Interventional	Radiography	Mammography
Bangladesh			√	
China	√			
Indonesia	√			
Japan	√			
Malaysia	√			√
Myanmar	√			
Pakistan	√	√		√
Singapore	√			
Sri Lanka	√			
Thailand	√	√	√	
Tajikistan		√		

Latin America

Country	CT	Interventional	Radiography	Mammography
Brazil	√			
Costa Rica	√			
Mexico	√			
Paraguay	√			
Peru	√			

Publications

Safety Guides

Technical Documents

Safety Standards

Radiological Accidents

Safety Reports

Other Publications

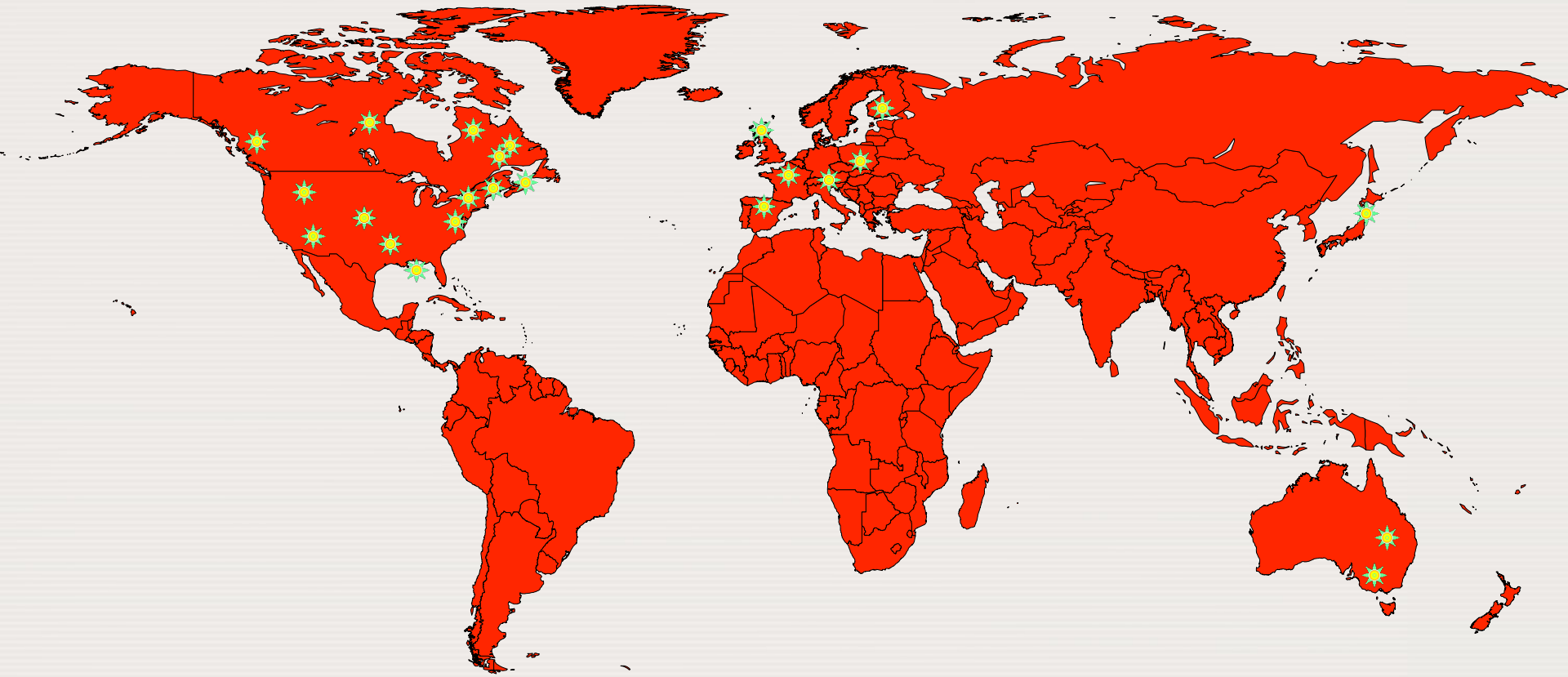
The above links bring you to the relevant IAEA publications (mainly in English, but also in language versions where available). Orders and requests for information about these publications may be addressed directly to the IAEA Sales and Promotion Unit.

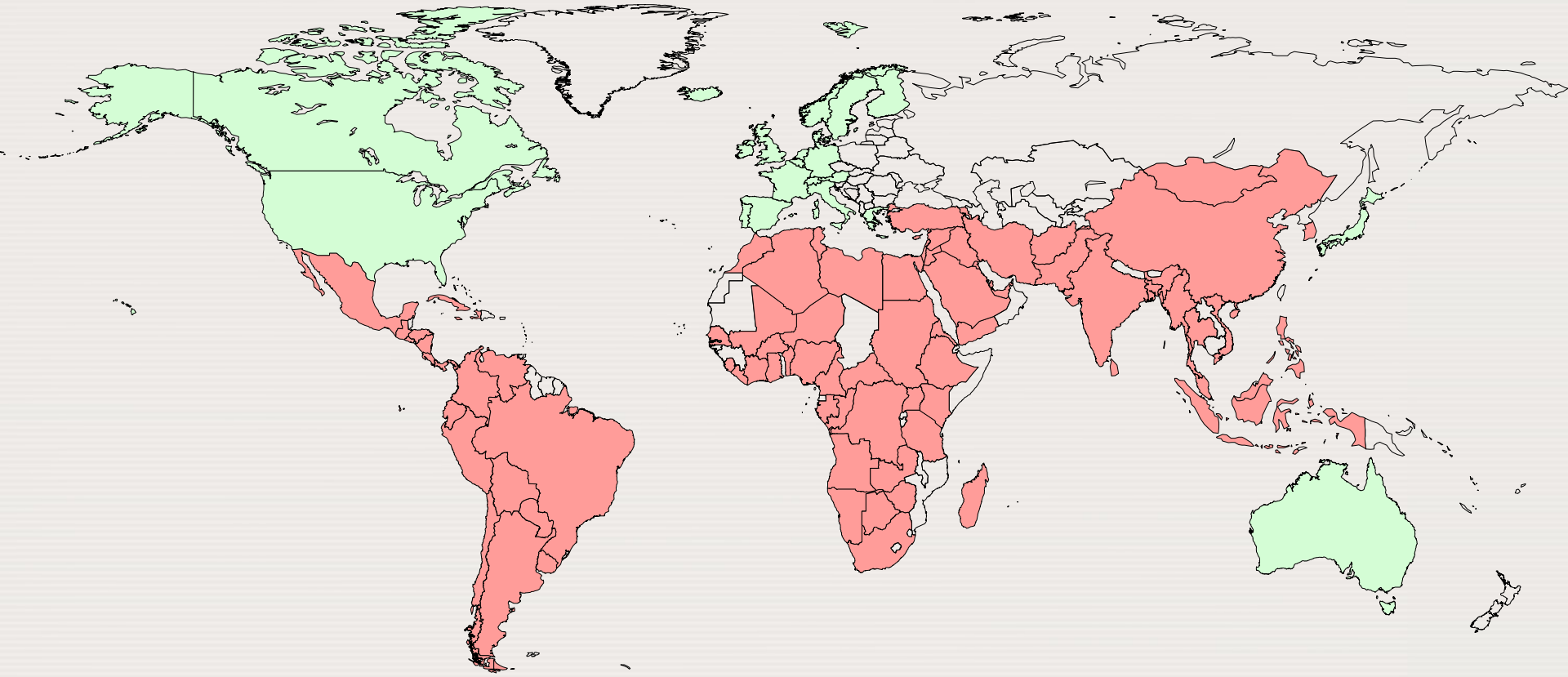
IAEA Work Published in Medical Journals

20
Top down

50
Bottom up

2001 Situation of optimization in radiological imaging

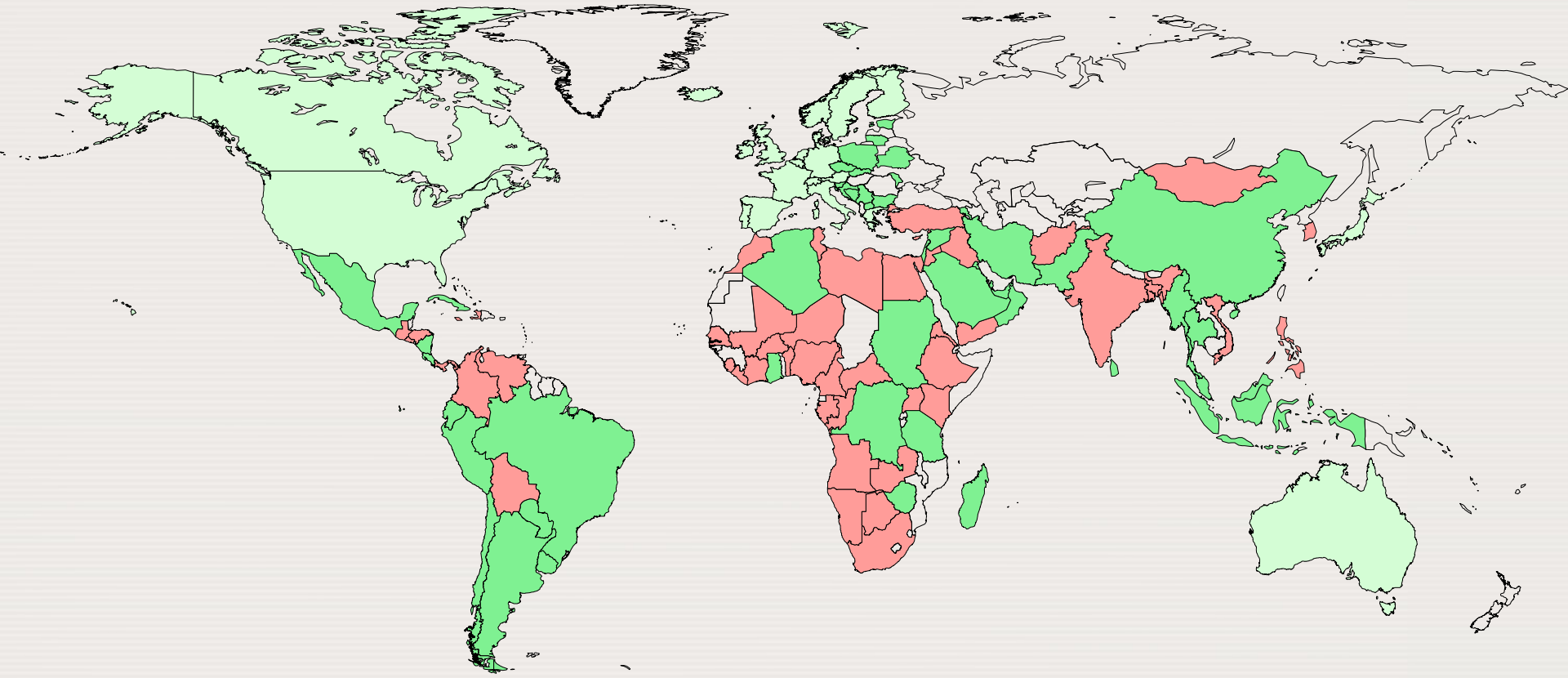




Developed Counties

Developing Counties

Patient Doses in Radiographic Examinations in Asia, Africa, Latin America and Eastern Europe



Algeria	China	FYR Macedonia	Madagascar	Oman	Singapore	United Arab Emirates
Argentina	Costa Rica	Ghana	Malaysia	Pakistan	Slovakia	Uruguay
Armenia	Croatia	Indonesia	Malta	Paraguay	Slovenia	Zimbabwe
Belarus	Cuba	Iran	Mexico	Peru	Sri Lanka	
Bosnia and Herzegovina	Czech Republic	Israel	Moldova	Poland	Sudan	
Brazil	Dem. Rep. of Congo	Kuwait	Montenegro	Qatar	Syria	
Bulgaria	Ecuador	Lebanon	Myanmar	Saudi Arabia	Tanzania	
Chile	Estonia	Lithuania	Nicaragua	Serbia	Thailand	

While DOING is best way to communicate message and to learn, there is limited outreach of projects aimed at making people do

Besides engaging professionals in project work, satisfying their information needs

Website http://rpop.iaea.org

IAEA | Radiation Protection of Patients (RPoP)

Search RPoP: GO

Home | Information for | Additional Resources | Special Groups | Member Area | About Us | Our Work | IAEA.org

Be Informed About the *Safe Use* of Ionizing Radiation in Medicine

Information to help health professionals achieve safer use of radiation in medicine for the benefit of patients

Information For
Health Professionals
Member States
Patients

Additonal Resources
Publications
International Standards
Training

Special Groups
Pregnant Women
Children

Member Area
Member States Area
Drafts Management Area

Actions to Protect Patients In:
- Radiology
- Radiotherapy
- Nuclear Medicine
- Interventional Radiology
- Interventional Cardiology
- Other Specialities & Imaging Modalities

Latest Literature

Ferrandino, M.N., Bagrodia, A., Pierre, S.A., Scales, C.D. Jr., Rampersaud, E., Pearle, M.S., Preminger, G.M.,
Radiation exposure in the acute and short-term management of urolithiasis at 2 academic centers, J. Urol. **181** 2 (Feb. 2009) 668-672.

Keeley, F.X., Jr, Thornton, M.,
Radiation safety: Implications for urologists and patients, J. Urol. **181** 2 (Feb. 2009) 443-444.

Vano, E., Ubeda, C., Leyton, F., Miranda, P., Gonzalez, L.,
Staff Radiation Doses in Interventional Cardiology: Correlation With Patient Exposure, Pediatr. Cardiol. (Jan. 2009)

Did You Know That...

3. It is safe to have an X ray examination of the extremities (feet, [illegible]) provided the examination is clinically justified and radiation protection principles are observed

« Prev Next »

Latest News

New Publications on Newer Imaging Techniques released
Download FREE three new [illegible] on radiation protection in newer imaging techniques (PET/CT, Cardiac CT and CT colonography)

Cardiologists' Newsletter
Next issue of the Newsletter of the Asian Network of Cardiologists in Radiation Protection is now available

All News

Upcoming Events

Meeting planned to prepare contents for patient information part of this website, Vienna, 4-8 May 2009
Meeting to discuss framework for patient information, draw guidelines and prepare contents

Meeting for Smart Card for long term record of patient doses, Vienna, 27-29 April 2009
The first meeting on this project will be held in IAEA Vienna

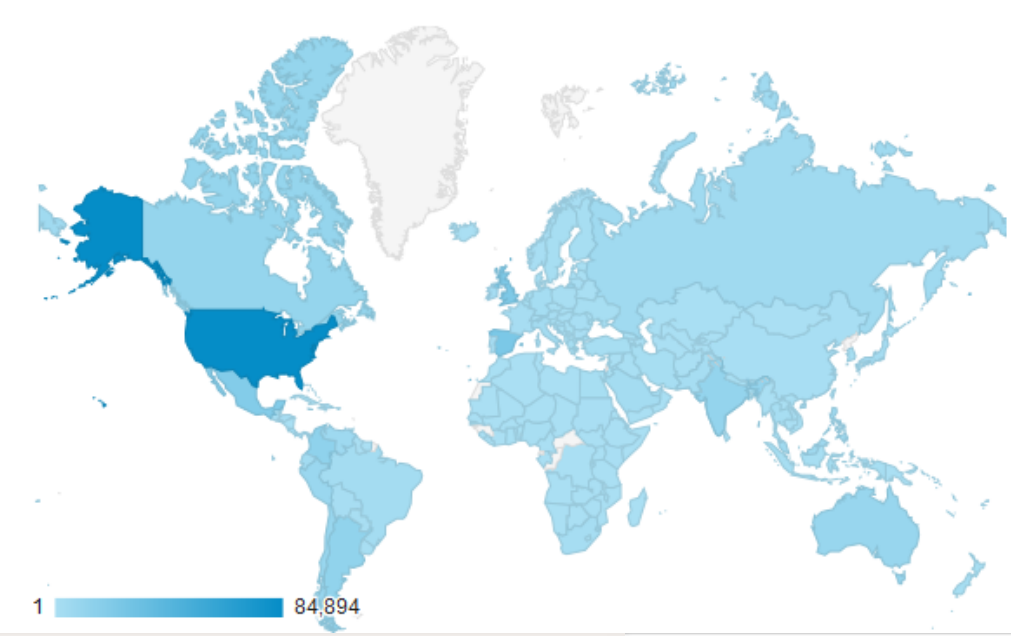
All Events

First page of Google search

15 million hits/y

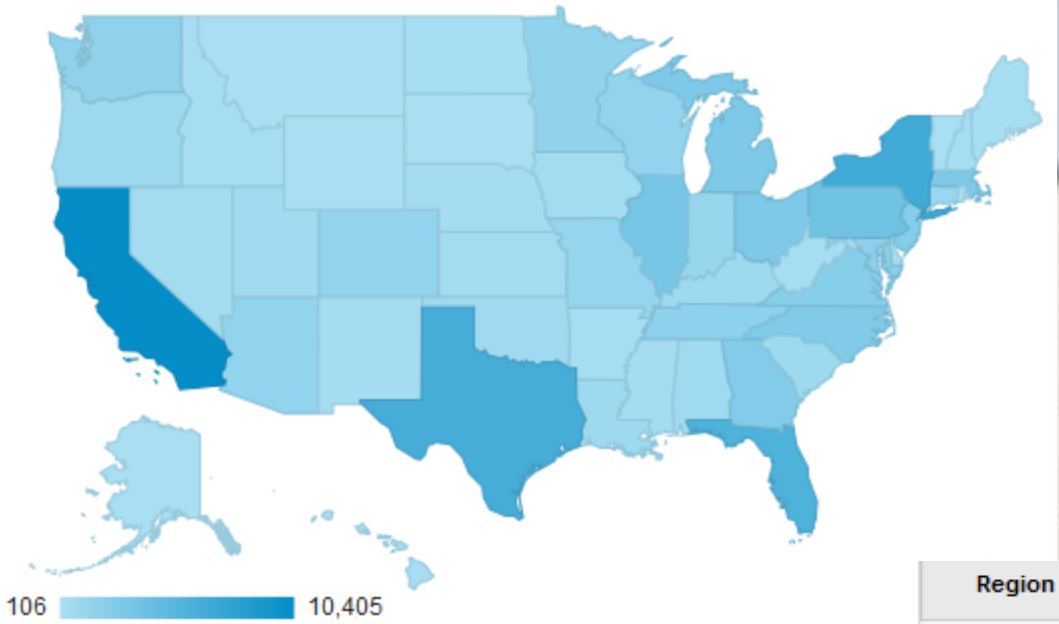
≈250,000 visits/y, 190 countries

1 Sept 12-30 Aug 13



USA
Not participant in TC projects but it benefits from information on website & training material

	Visits	Pages / Visit
	352,577 % of Total: 100.00% (352,577)	1.83 Site Avg: 1.83 (0.00%)
1. United States	84,894	1.52
2. Spain	23,943	1.76
3. United Kingdom	22,427	1.56
4. Mexico	19,873	1.47
5. Colombia	13,780	1.53
6. Argentina	12,627	1.74
7. India	11,496	1.93
8. Canada	10,832	1.54
9. Australia	9,499	1.61
10. Chile	9,199	1.65



Region	Visits
	84,894 % of Total: 24.08% (352,577)
1. California	10,405
2. New York	6,675
3. Texas	6,341
4. Florida	5,792
5. Pennsylvania	3,749
6. Illinois	3,196
7. Ohio	2,920
8. Michigan	2,903
9. Massachusetts	2,849
10. North Carolina	2,679

City	Visits
	10,405 % of Total: 2.95% (352,577)
1. Los Angeles	1,680
2. San Francisco	998
3. San Diego	751
4. San Jose	422
5. Sacramento	291
6. Long Beach	168
7. Fresno	140
8. San Gabriel	133
9. Irvine	126
10. Palo Alto	126

11.	Peru	8,208	29.	Dominican Republic	1,801		
12.	(not set)	7,649	30.	Singapore	1,782		
13.	Venezuela		48.	Sweden	1,354		1,713
14.	Russia		49.	Turkey	1,353		1,634
15.	Malaysia		50.	Albania	1,171		1,620
16.	Philippines		51.	Uruguay	1,167		1,617
17.	Ecuador		52.	Guatemala	1,166		1,615
18.	Brazil		53.	Poland	1,053		1,533
19.	Saudi Arabia		54.	Taiwan	1,052		1,489
20.	Italy		55.	Nigeria	1,032		1,486
21.	Ireland		56.	Paraguay	986		1,464
22.	Germany		57.	Czech Republic	972		1,449
23.	United Arab Emirates		58.	Switzerland	953		1,417
24.	Japan		59.	Panama	936		1,415
25.	Puerto Rico		60.	Israel	921		1,404
26.	South Africa		61.	China	907		1,395
27.	Costa Rica		62.	Norway	883		1,378
28.	Pakistan		63.	Romania	855		1,364
			64.	Lithuania	796		1,355
			65.	Bulgaria	763		

Networks

Radiation Protection of Children
(Asian Network under IAEA project RAS9055)

Newsletter
Issue No. 1
February 2011

Mission: To promote a rational and safe practice of medical radiation exposure in children

Network of Gastroenterologists in Radiation Protection in Latin American Countries
-under IAEA project RLA 9067

Newsletter
Issue No. 3

Mission: To enhance cooperation among gastroenterologists on radiation safety in procedures that utilize ionizing radiations

Asian Network of Cardiologists in Radiation Protection

Asian Network of Cardiologists in Radiation Protection – under RCA/IAEA project

Mission: To enhance cooperation among cardiologists on radiation safety in cardiac catheterization procedures and in procedures that utilise ionizing radiations

The IAEA in 2007 established an Asian network of

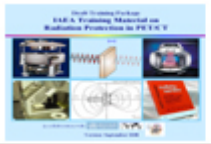
1957–20

Medical Radiation Protection

Networks

Training Courses
≈80 since 2002

Patient protection



Free Material

Email received by IAEA on 21st Oct.08

Requesting your help please!

I have a chronic radiation burn which has been ulcerated for months! (Pathology report)

Causes:

- **Angioplasty procedure that lasted 3.5 hours, 2 stents placed in lad which was 100% blocked.**
- **Couple of weeks later the burn came out on by left lower back about the size of a deck of cards.**
- **Procedure was done by cardiologist on Jan. 31, 2008**

I have been suffering with this for 9 months and still it does not seem this is going to heal. It has shrunk but is not relieving me in pain.

Issues:

- **I have been to my cardiologist, 2 dermatologists none of which had ever seen or knew how to treat this burn.**
- **I am now at a plastic surgeon**

this situation

IAEA | Safety in Radiological Procedures (SAFRAD)

Safety in Radiological procedures

Cardiac Catheterization Lab, San Carlos Hospital, Madrid

The IAEA has a sub-programme on Radiation Protection of Patients that operates under an International Action Plan. This is the first ever programme dedicated to radiation protection of patients started in 2001 by an international organization. A dedicated website was established in 2006 that is becoming a popular resource for credible information for health professionals, patients and public.

The website provides information on radiation safety in interventional procedures besides other areas in radiology, radiotherapy, nuclear medicine, dental radiology, pregnancy and for children. Also training material has been provided for free download for use by health professionals.

SAFRAD (SAFety in RADiological procedures) is a voluntary reporting system where patients submitted to defined trigger levels or events in fluoroscopically-guided interventional procedures are included in an international database. The primary objective of the system is educational in nature. It is believed that going through the process of SAFRAD itself results in safety. For more information about SAFRAD, click here.

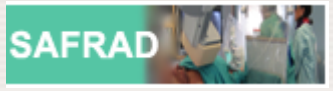
Medical Radiation Protection

Networks

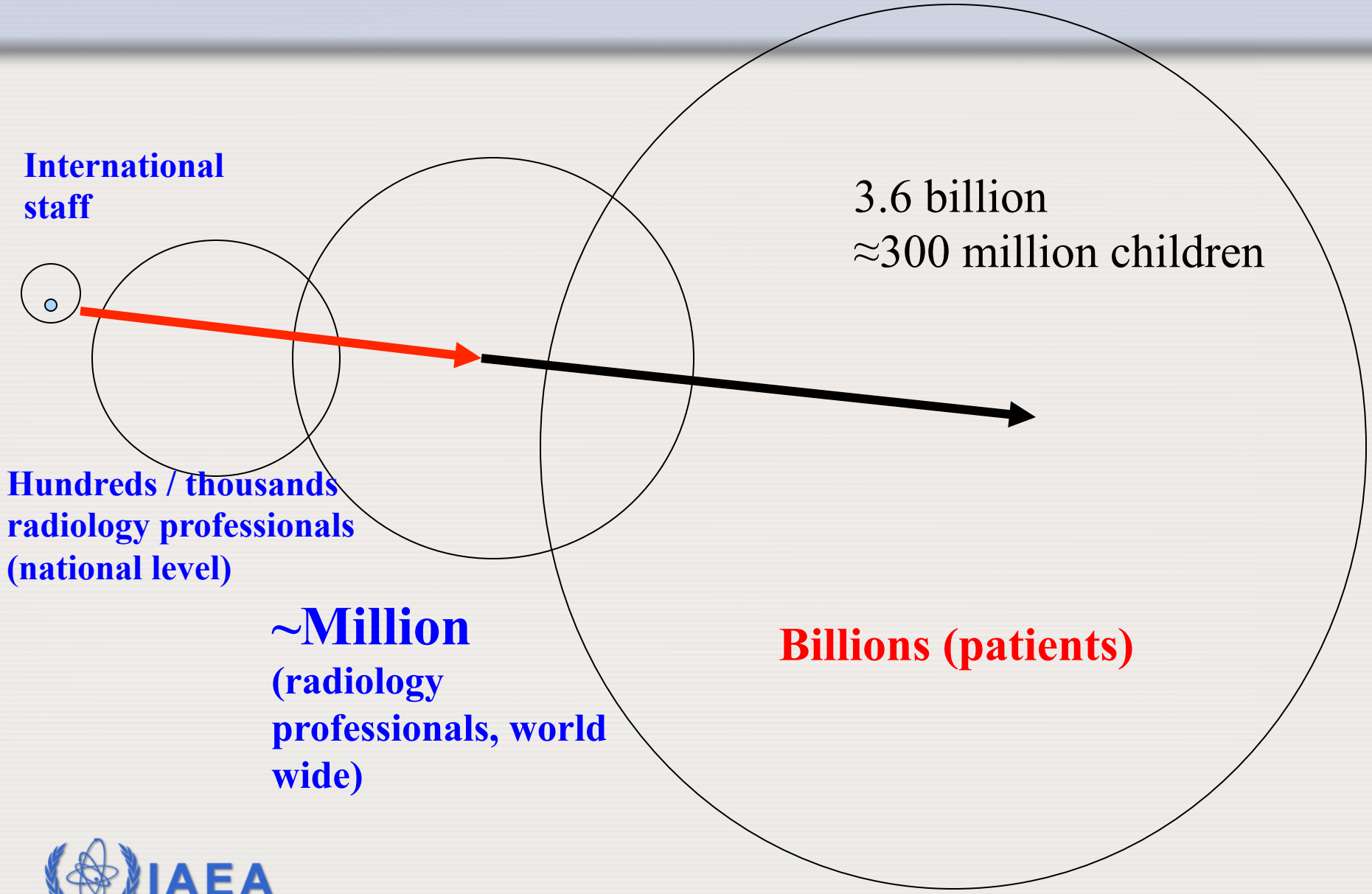
Training Courses
≈80 since 2002

Patient protection

Free Material

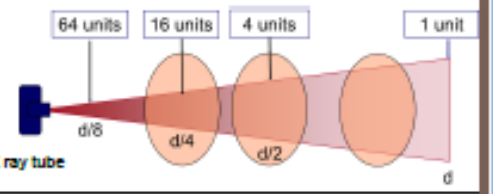


Medical Radiation Protection



10 Pearls: Radiation protection of *patients* in fluoroscopy

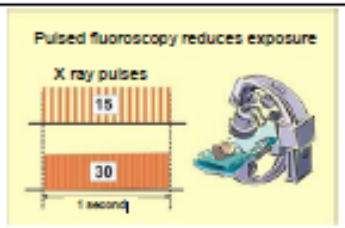
1. Maximize distance between the X ray tube and the patient to the extent possible



2. Minimize distance between the patient and the image receptor

3. Minimize fluoroscopy time

Keep records of fluoroscopy time for every patient



4. Use pulsed fluoroscopy with the lowest frame rate possible to obtain images of acceptable quality

5. Avoid exposing the same area of the skin in different projections

Vary the beam entrance port by rotating the tube around the patient

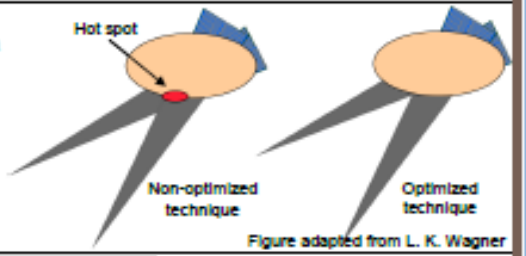


Figure adapted from L. K. Wagner

IAEA RPOP Radiation Protection of Patients

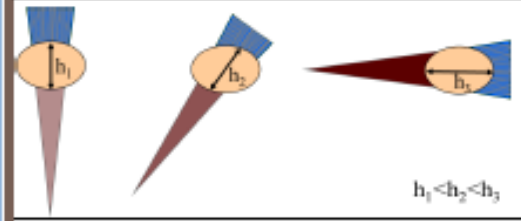
Related Poster!
10 pearls! Radiation protection of staff in fluoroscopy

http://rpop.iaea.org

Page 1 of 2
Fluoroscopy
Patient Radiation Protection

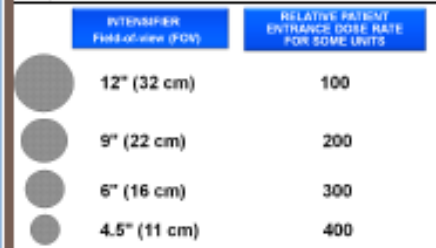
10 Pearls: Radiation protection of *patients* in fluoroscopy

6. Larger patients or thicker body parts trigger an increase in entrance surface dose (ESD)



7. Oblique projections also increase ESD

Be aware that increased ESD increases the probability of skin injury



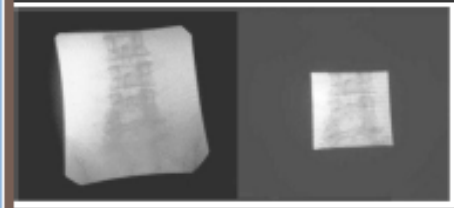
8. Avoid the use of magnification

Decreasing the field of view by a factor of two increases dose rate by a factor of four

9. Minimize number of frames and cine runs to clinically acceptable level

Avoid using the acquisition mode for fluoroscopy

Documentation should be performed with last image hold whenever possible and not with cine images



10. Use collimation

Collimate the X ray beam to the area of interest

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Related Poster!
10 pearls! Radiation protection of staff in fluoroscopy

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Page 2 of 2
Fluoroscopy
Patient Radiation Protection

10 Pearls: Radiation protection of *staff* in fluoroscopy

Reducing patient dose always results in staff dose reduction

1. Use protective devices!

Advisable skirt type lead apron to distribute weight

0.25 mm lead equivalence but with overlap on front to make it 0.5 mm on the front and 0.25 mm on the back (Provides >90% protection)

Lead glass eyewear with side protection

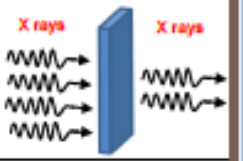
Thyroid protection

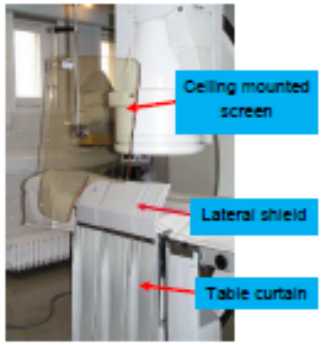
2. Make good use of time-distance-shielding (TDS) principle

Minimize time

Maximize distance as much as clinically possible

Use shielding





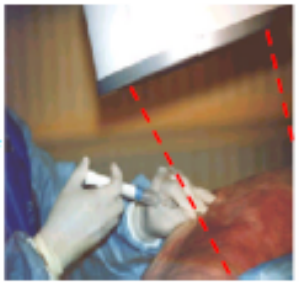
3. Use ceiling suspended screens, lateral shields and table curtains

They provide more than 90% protection from scattered radiation in fluoroscopy

Mobile floor shielding is advisable when using cine acquisition

4. Keep hands outside the primary beam unless totally unavoidable

Hands inside the central area of the primary beam will increase exposure factors (kV, mA) and doses to patient and staff



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10 Pearls: Radiation protection of *staff* in fluoroscopy

Reducing patient dose always results in staff dose reduction

Right!

Wrong!

5. Only 1-5% of radiation falling on the patient's body exits the other side

Stand on the side of the *transmitted* beam (i.e. by the detector), which contains only 1-5% of the incident radiation and its respective scatter

6. Keep X ray tube under the patient table and not over it

Undercouch systems provide better protection from scattered dose

Right!

Wrong!

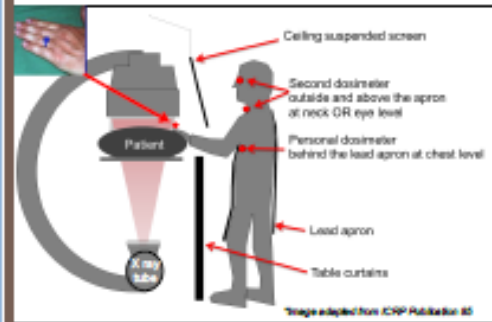

*Image adapted from ICRP Publication 85

7. Use personal dosimetry

Use at least two dosimeters

- One inside the apron at chest level
- One outside the apron at neck or eye level
- Additional finger ring dosimeter for procedures requiring hands close to primary beam

Real time dosimetry systems are useful

8. Update your knowledge about radiation protection

9. Address your concerns about radiation protection to radiation protection specialists (medical physicists)

10. REMEMBER!

- Quality control testing of fluoroscopy equipment enables safe and stable performance
- Know your equipment! Using the equipment's features appropriately will help reduce doses to patients and staff
- Use injector devices

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Fluoroscopy Staff Radiation Protection

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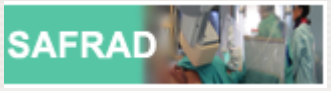
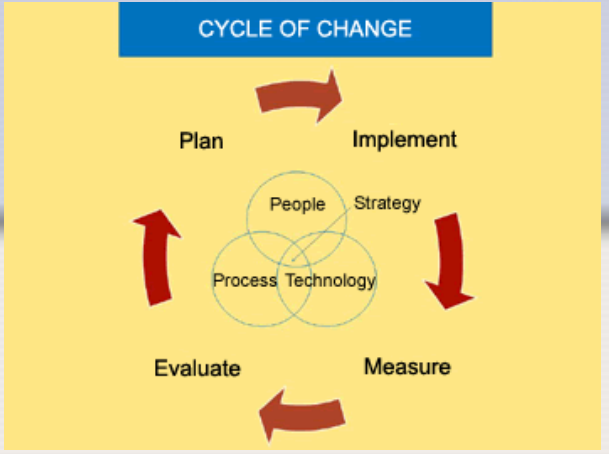


Posters

Strategies & Approaches

- Not as a funding agency
- Scientific coordinator/facilitator
- As facilitator of cooperation (bottom up)
- Creation of an environment of learning
- Conceive, plan, get funds allocated, execute, mentor, analyze data and publish
- National data publication by country
- Multinational by HQ



Change in knowledge

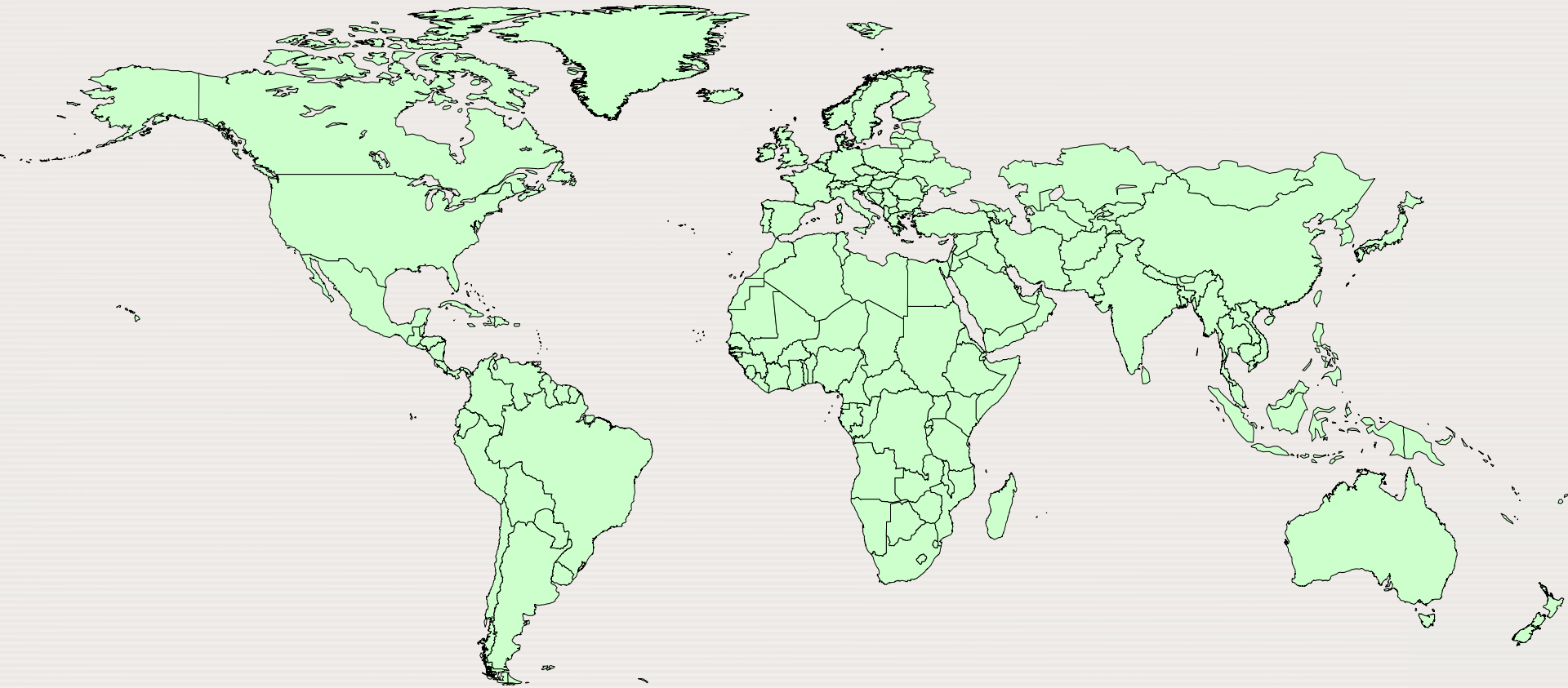
Change in awareness and interest

Change in attitude

Change in practice

Are we doing or are we making change?

Vision: World map of patient safety situation
Justification, Optimization



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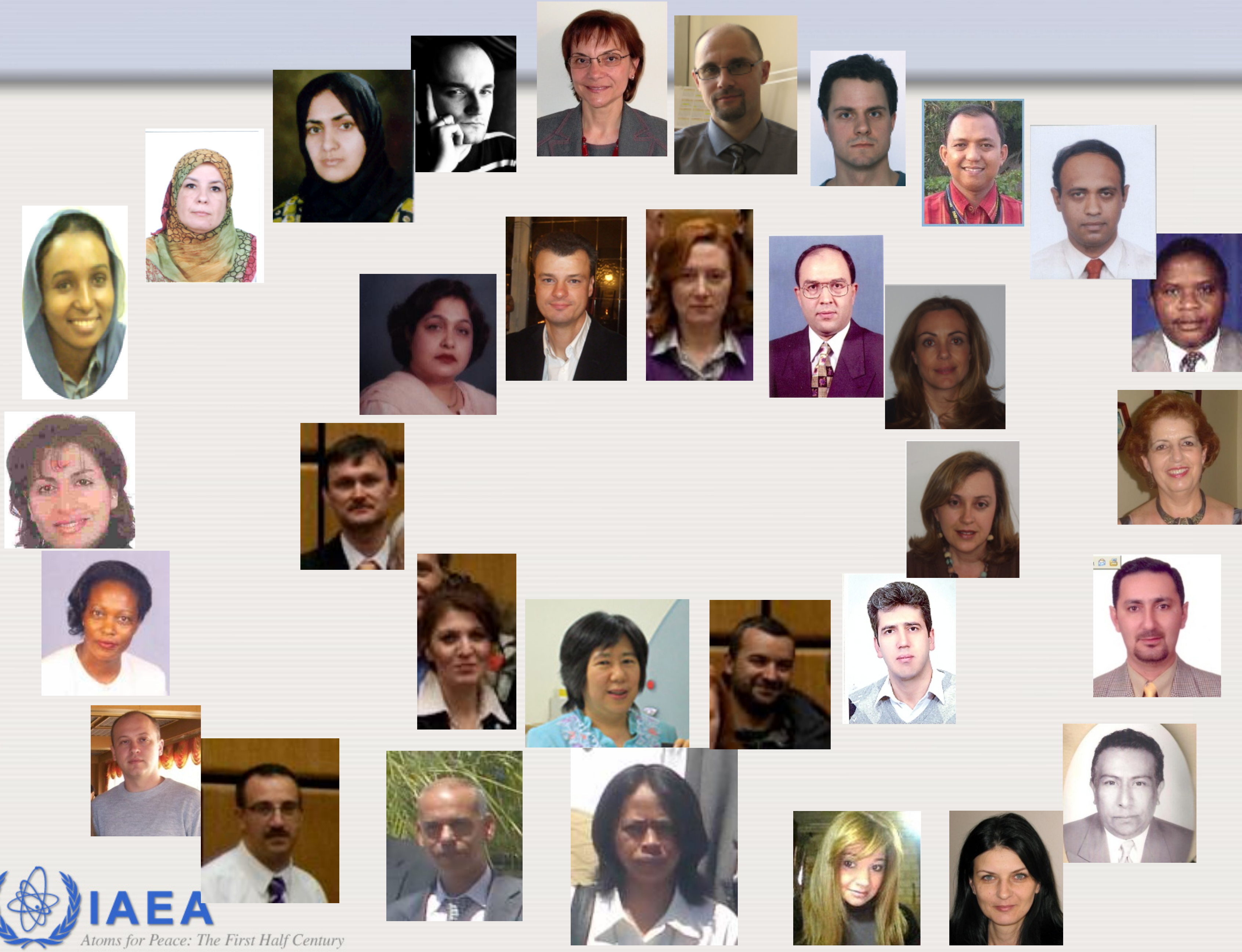
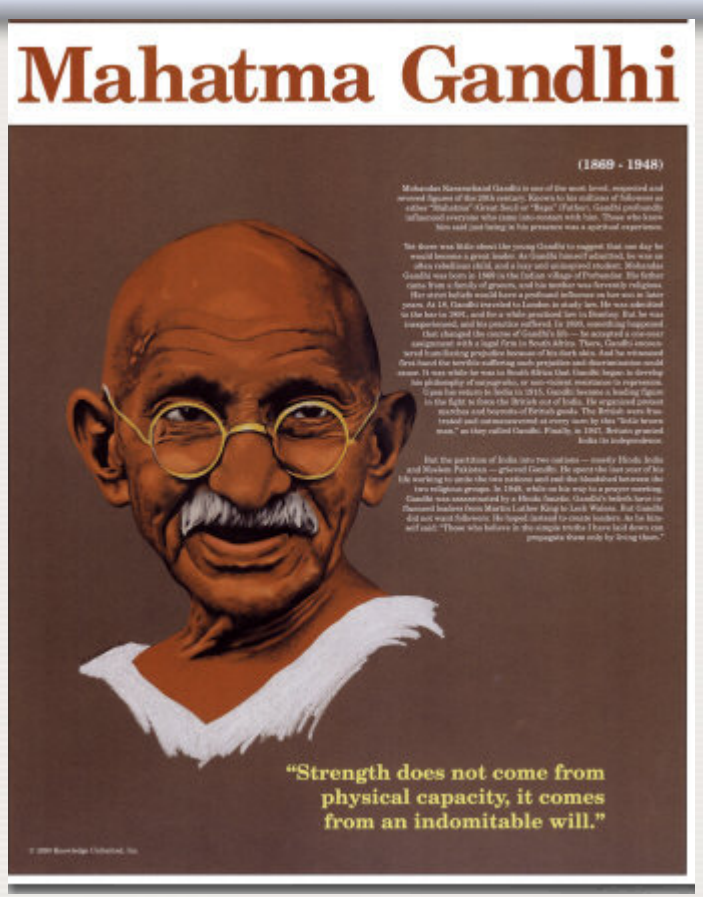
Some participants in projects



"Whatever you do will be insignificant, but it is very important that you do it"



Thank You

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