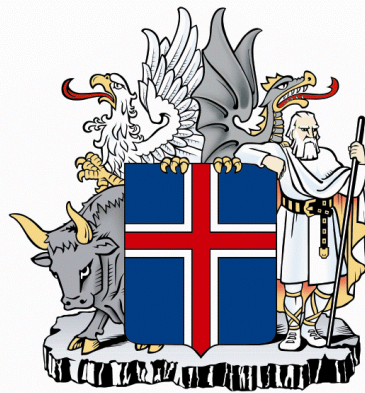


Frequency of Medical X-ray Examinations and Patient and Population Doses in Iceland in 2008.

Guðlaugur Einarsson



GEISLAVARNIR RÍKISINS
ICELANDIC RADIATION SAFETY AUTHORITY

Introduction

- The Radiation Protection act of 2002 (nr. 44)
The IRSA shall collect information about the use of radiation in medical diagnosis and treatment with the aim to analyze:
 - Trends in Mean Effective Dose (ED) of procedures
 - Trends in Collective Effective Dose (CED)
- Since 1993 IRSA has collected information about the number of procedures with questionnaires to all hospitals, clinics and health centres using medical x-ray equipment
- Data collection on frequency of medical imaging procedures every 5 years; in 1993, 1998, 2003, 2008



Materials and Methods

- Data collection on frequency of medical imaging procedures in 2009 for 2008.
- From 35 locations with x-ray equipment
 - University hospital and regional hospitals (9)
 - Health Clinics (4)
 - Regional Health Care Centres (22) (Small hospitals and health care centres around the country)
- Radiological examination codes are used to sort between different examinations. These codes have over the years been adapted and revised to facilitate changes -
- X-ray examinations sorted in categories based on EU report no.154



Materials and Methods

- Collection of patient dose information and evaluation of ED have been done twice for different periods;
 - In 1994-1998 used to estimate for 1996
 - In 2004–2009 used to estimate for 2008
- Information collected are:
 - Examination information
 - Patient information
 - Entrance Surface Dose (ESD) for mammography (17000)
 - Dose Area Product (DAP) (4000 measurements)
 - Dose Length Product (DLP) for CT examinations (900).
- Assessment of ED and CED done according to EU Radiation Protection Report no. 154 (2008)



Results on examination frequency

- About 99% of all examinations are stored in the 6 PACS systems in operation (LSH, FSA, ÍM, LM, KÍ, Hjartavernd).
- 98% of all examinations are performed in 17 places
- 83% of all examinations are performed at 5 places
- 35% of all examinations are performed in the 2 privately run clinics
- Less than 1% of examinations are on films
- There are still a number of small health care centres that are using films-screen systems

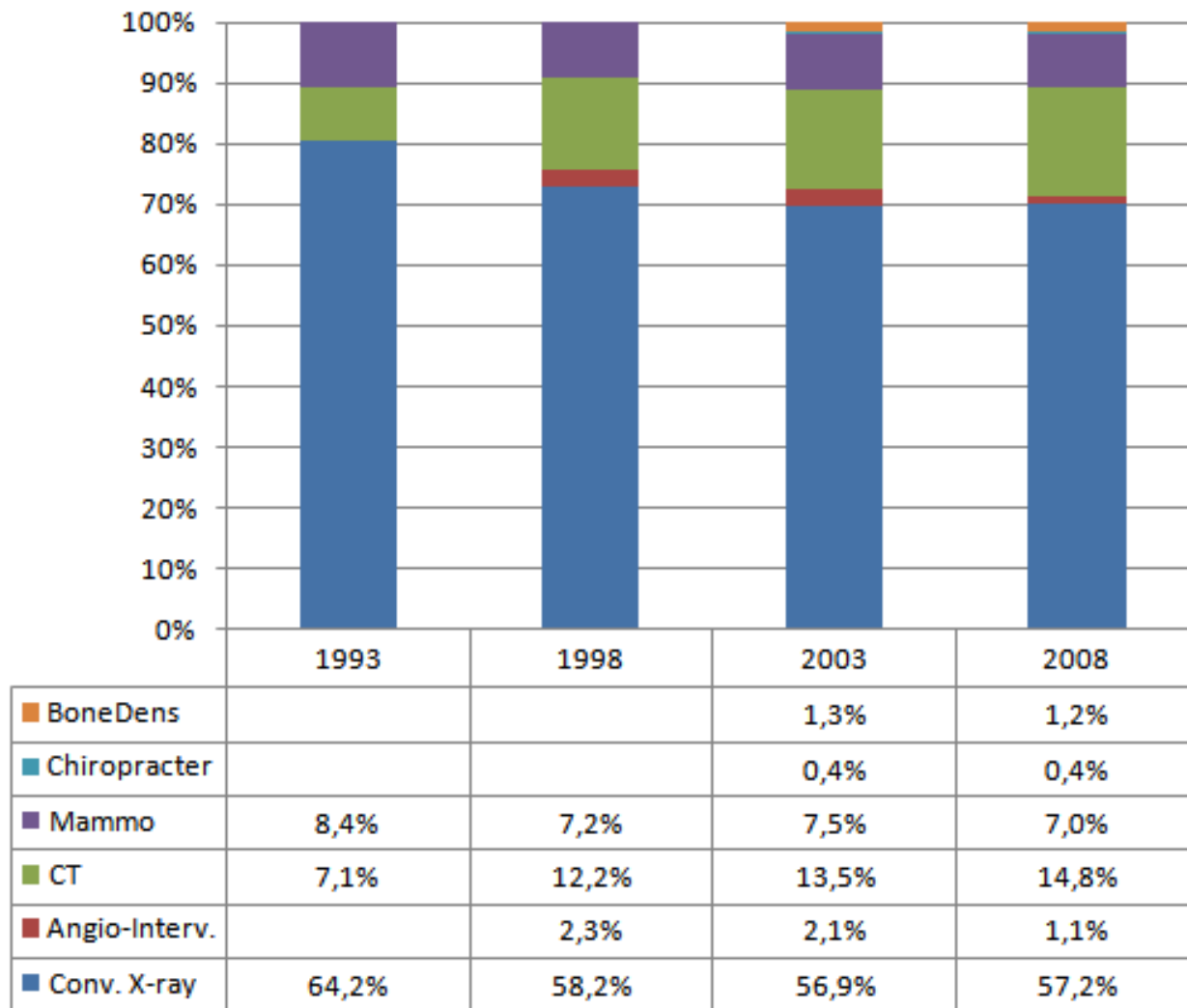


Trends in examination frequency

Frequency of Radiological Examinations 1993 - 2008						
Examination Categorie	1993	1998	2003	2008	Change 03/08	Freq. '08 exam/1000
Conventional x-ray	100.372	119.611	131.823	178.160	35,2%	565
Angiography+Intervention		4.714	4.949	3.486	-29,6%	11
Computed Tomography	11.042	25.141	31.185	46.181	48,1%	146
Mammography	13.163	14.872	17.291	21.811	26,1%	69
Chiropractors			914	1.349	47,6%	4
Bone Dens. + Research			3.000	3.849	28,3%	12
Total x-ray	124.577	164.338	189.162	254.836	34,7%	808
exam. per 1000 / inhabitants	475	603	656	808		
MRI	4.048	6.443	9.913	23.162	133,7%	73
Ultrasound	20.283	29.097	26.441	29.815	12,8%	95
Nuclear Medicine	7.483	5.492	6.300	3.674	-41,7%	12
All examination	156.391	205.370	231.816	311.487	34,4%	987
exam. per 1000 / inhabitants	596	754	804	987		



Trends in x-ray examinations



Results on patient doses

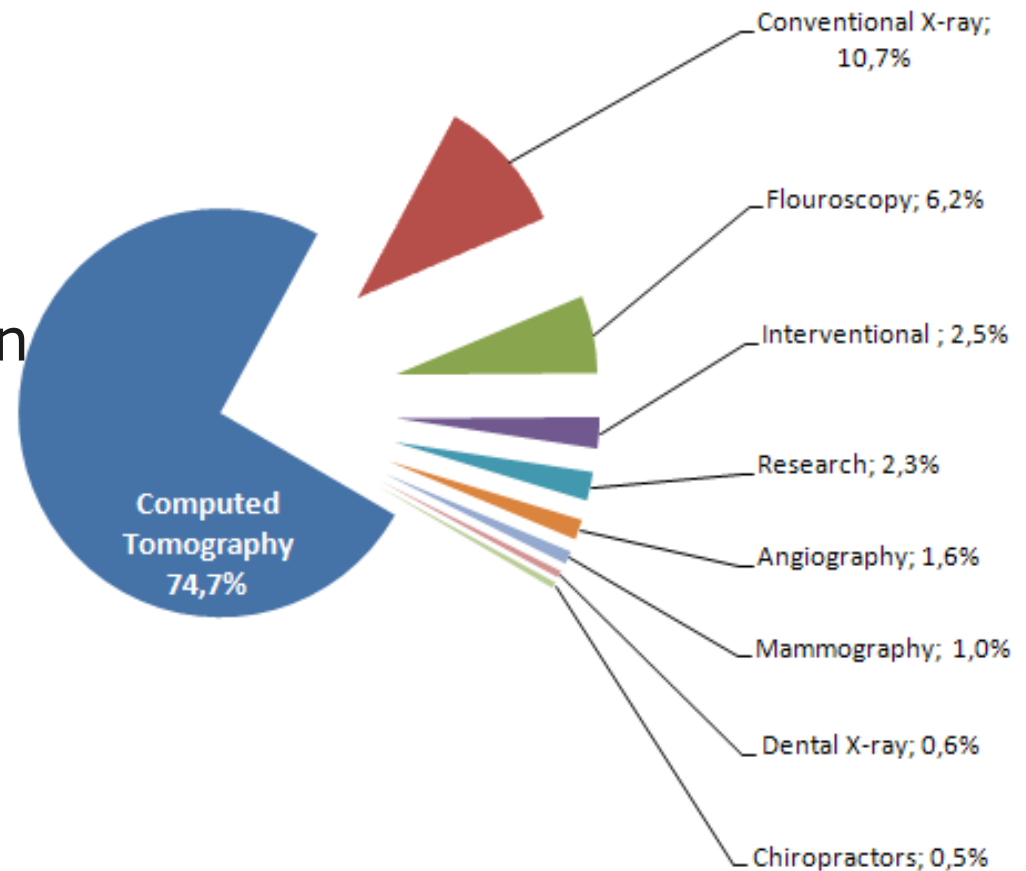
No. of X-ray examinations, mean ED and CED for different categories of examinations.

<i>Examination Categories</i>	<i>Number of Examinations</i>	<i>ED mSv</i>	<i>CED manSv</i>	<i>%</i>
All Conventional X-ray Examinations	181.640	0,53	97,4	21,0%
Computer Tomography examinations	46.181	7,52	347,1	74,8%
Mammography examinations	21.811	0,22	4,8	1,0%
Research examinations	843	12,6	10,6	2,3%
Chiropractic x-ray examinations	1.349	1,64	2,2	0,5%
Bone densitometry examinations	3.015	0,009	0,03	0,0%
Dental examinations	450.000	0,004	1,7	0,4%
Total :	704.839		463,9	



Results - key figures

- Collective Effective Dose - 464 manSv
 - Increase by 150% from 1996
 - 75% from CT exam.
 - 1,46 mSv/caput
 - 1,81 mSv / examination



Trends in patient doses

Changes in ED for different x-ray examinations			
<i>Conventional</i>	<i>1996</i>	<i>2008</i>	<i>Change in dose</i>
<i>X-ray examinations</i>	<i>mSv</i>	<i>mSv</i>	<i>%</i>
Abdomen	1,35	2,9	117
ERCP	4,41	7,7	75
Chest/Thorax/Lungs	0,10	0,13	30
Pelvis	0,72	0,81	13
Hips (both)	0,65	0,72	11
Col. Thoracalis	0,71	0,77	8
Urography (IVP)	3,5	3,4	-3
Col. Lumbal Sacral	2,04	1,98	-3
Angiographies	4,2	4,0	-4
Abdomen (kidneys)	1,33	1,25	-6
Knee	0,012	0,01	-17
Col. Cervicalis	0,17	0,14	-18
MUCG	10,7	8,3	-22
Lumbal Myelography	4,72	3	-36
Cranium	0,05	0,03	-40
Total Columna	2,23	1,1	-51
Femur	0,08	0,034	-58
Pelvimetry	2,59	1,1	-58



Trends in patient doses

Changes in ED for different CT examinations.

	1996	2008	Change in dose
<i>CT X-ray examinations</i>	<i>mSv</i>	<i>mSv</i>	<i>%</i>
Lumbar spine	3,25	11,8	263
Head (Brain)	1,34	3,0	127
Skull and facial bones	1	1,6	61
Pelvic bones	6,1	8,5	40
Head (soft tissue)	1	1,1	7
Abdomen	13,2	14,1	7
Neck	4	3,7	-7
Chest/Thorax	8,47	6,3	-25



Mean ED of selected examinations compared with mean ED for 12 different European Countries -TOP20 *

	<i>Iceland 2008</i>	<i>Mean effective dose and range in 12 European Countries</i>		<i>Difference</i>
		<i>mSv</i>	<i>range</i>	
<i>X-ray examinations</i>	<i>mSv</i>	<i>mSv</i>	<i>range</i>	<i>%</i>
Chest/Thorax/Lungs	0,13	0,09	(0,01 - 0,29)	31
Col. Cervicalis	0,14	0,23	(0,02 - 1,10)	-64
Col. Thoracalis	0,77	0,81	(0,30 - 3,50)	-5
Col. LumbalSacral	1,98	1,32	(0,40 - 4,10)	33
Mammography	0,2	0,2	(0,03 - 0,42)	0
Abdomen	2,9	1,19	(0,40 - 2,93)	59
Pelvis & hip	0,75	0,7	(0,25 - 2,0)	6
Barium Meal	3,4	6,38	(2,00 - 18,50)	-86
Barium-Enema	25,2	9,83	(2,60 - 25,73)	61
Ba follow	6,6	9,08	(0,63 -42,3)	-38
Urography (IVP)	3,4	2,91	(2,10 - 4,25)	14
CT-Head	2,5	1,95	(1,20 - 3,05)	22
CT-neck	5,4	2,7	(1,10 - 5,00)	50
CT-Chest	6,3	5,35	(3,50 - 7,37)	15
CT-Spine	11,8	7,04	(3,10 - 11,81)	40
CT-Abdomen	14,1	10,28	(5,30 - 17,90)	27
CT-Pelvis	9,3	7,65	(0,80 - 14,48)	18
* Olerud H.M. et al, 2010				

Conclusions

- Examination frequency has increased by 35% between 2003 and 2008
- CT examination's frequency has increase by 48% between 2003 and 2008
- Compared to 1996 the CED has increase by 150%
- CT contribution to CED has increased from 50% to 75%



Moving forward

- Results that will change priorities in our work in the coming years
- DRL's have not been updated since 1996 and are only for conventional x-ray procedures
- Methods for direct access to patient dose examination and dose information from PACS are being investigated.

