Ozračenje pacijenta pri radiodijagnostičkim postupcima u RH

Dario Faj, Medicinski fakultet Osijek, Sveučilište JJ Strossmayera u Osijeku
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Prosječne individualne doze (mSv/god)

PRIRODA 88 %

UMJETNI 12 %



Radon 54,5 %

Zemljina kora 19,5 %

Interno K-40, C-14 9,5 %

Svemir 16,5%

Medicina 97 %

Padaline 2 %

Radno mjesto 0,6 %

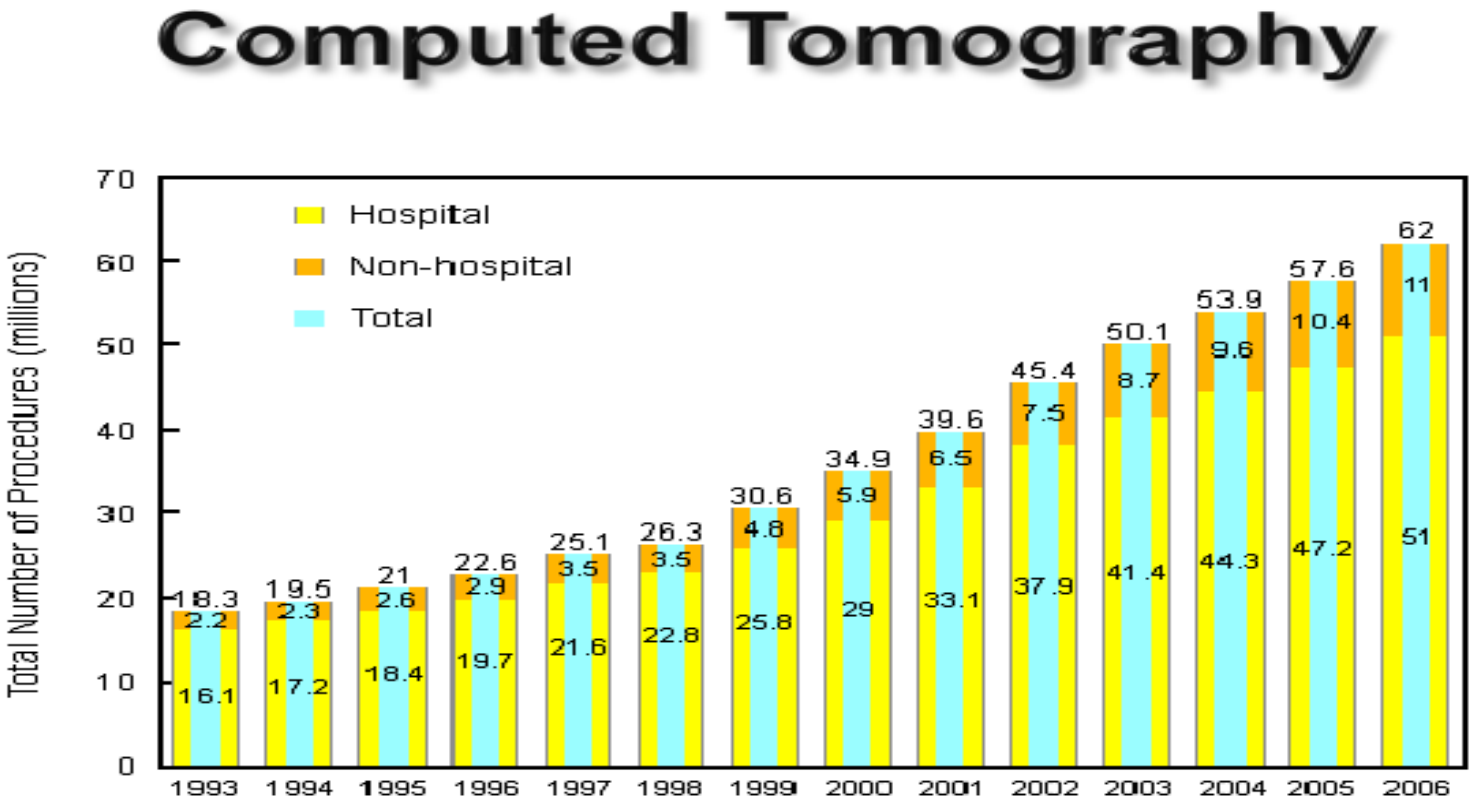
Ispusti 0,3 %

Proizvodi 0,1 %

UKUPNO = 2.69 mSv/god

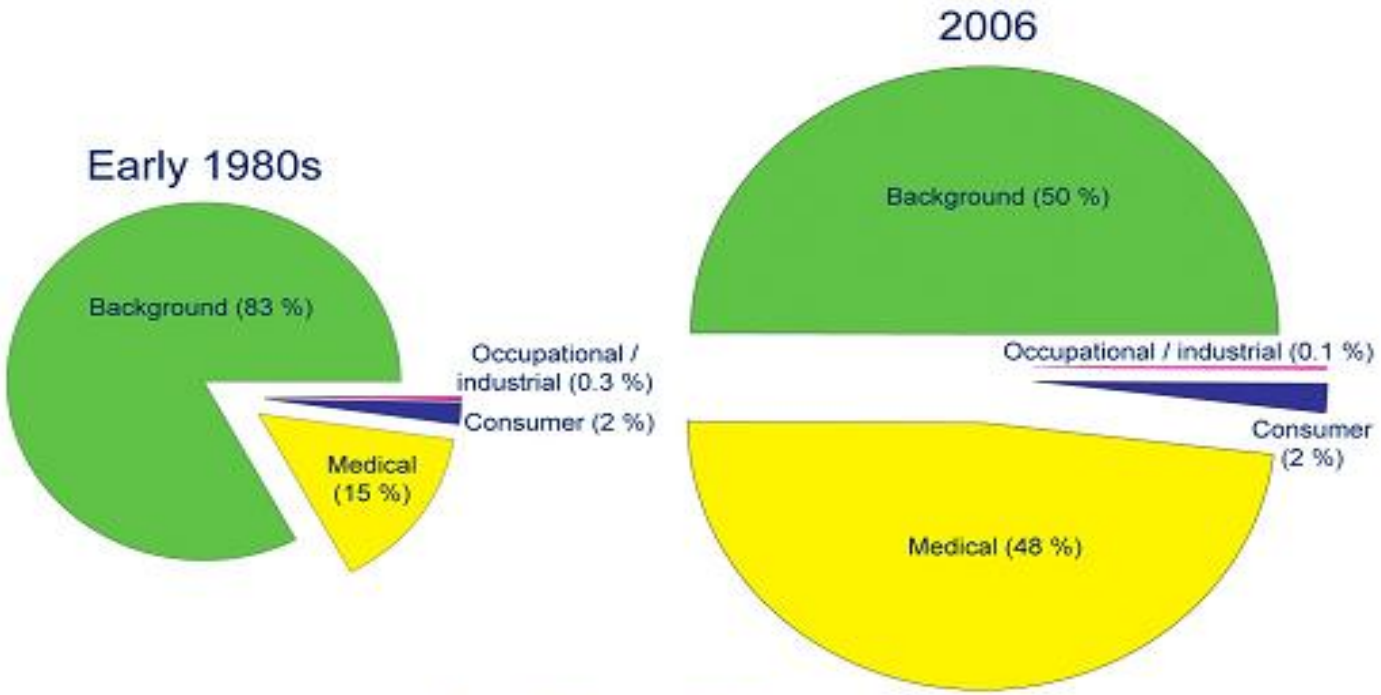
Izvor: UNSCEAR 2001

Porast broja postupaka



NCRP Report No. 160. Bethesda MD:NCRP; 2009

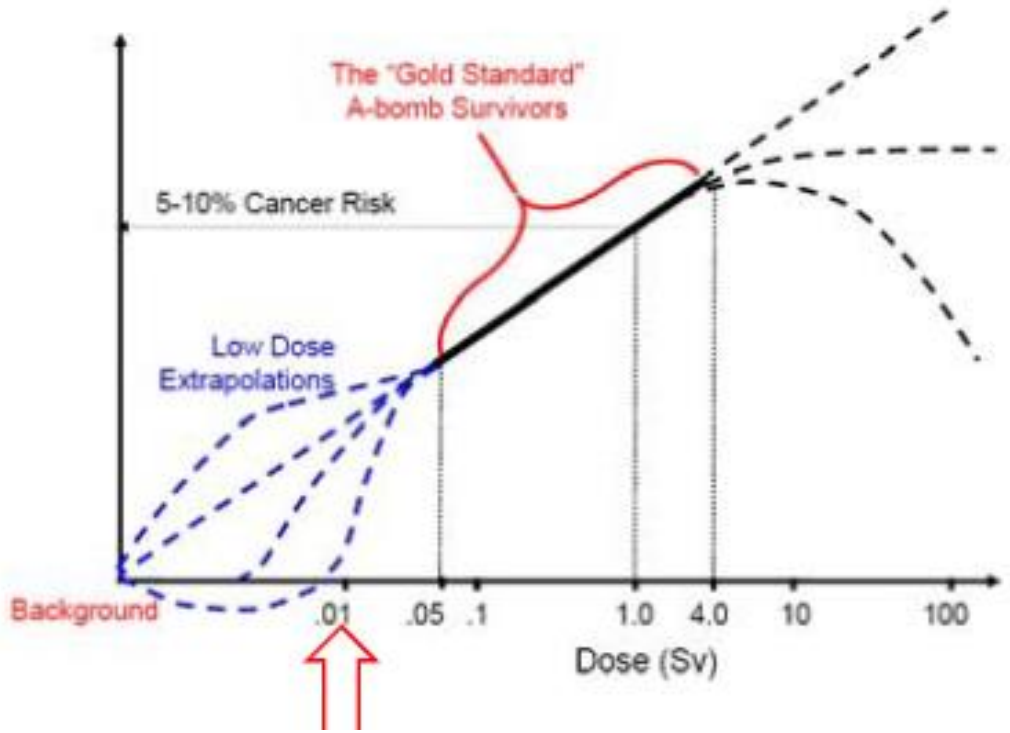
NCRP Report No. 160, *Ionizing Radiation Exposure of the Population of the United States*



	Early 1980s	2006
Collective effective dose (person-Sv)	835,000	1,870,000
Effective dose per individual in the U.S. population (mSv)	3.6	6.2

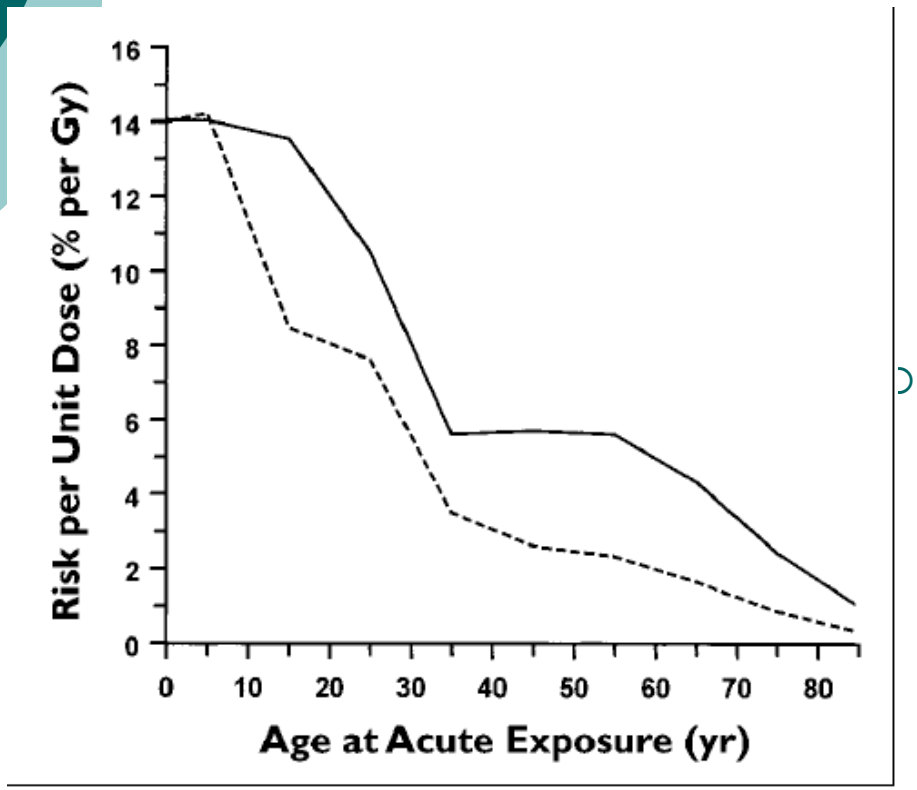
Rizik ozračenja I

- Male doze zračenja (u uporedbi s preživjelima A – bombe) opasne?
- Krivulja malih doza – teorijska!!



Hall at al, Pediatric radiology, 2002

Rizik ozračenja II



- Retrospektivna istraživanja čiji prvi rezultati pokazuju kako i male doze zračenja (u usporedbi s A bombom) mogu uzrokovati povećani rizik za pojavu leukemije i tumora mozga u mlađe populacije
- Pearce MS, Salotti JA, at al. Radiation exposure from CT scans in childhood and subsequent risk of leukaemia and brain tumours: a retrospective cohort study, Lancet, 2012
- http://epi-ct.iarc.fr/

Danas: Efektivne doze veće od 100 mSv?

- https://www.iaea.org/newscenter/news/strengthening-the-protection-of-patients-who-need-multiple-imaging-exams
- KBCO:program za praćenje doza
- https://qaelum.com/solutions/dose
- 15 pacijenata preko 100 mSv CED prošle godine u KBCO (mahom onkološki)

EU i RH?

DIRECTIVES

COUNCIL DIRECTIVE 2013/59/EURATOM

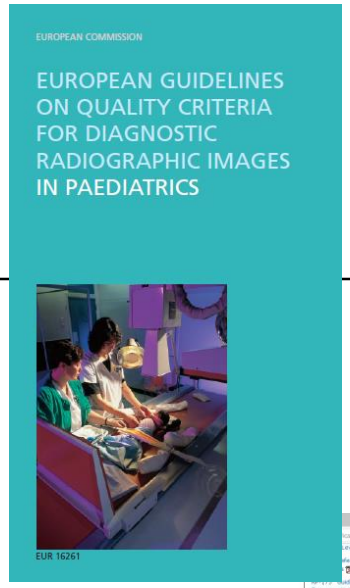
of 5 December 2013

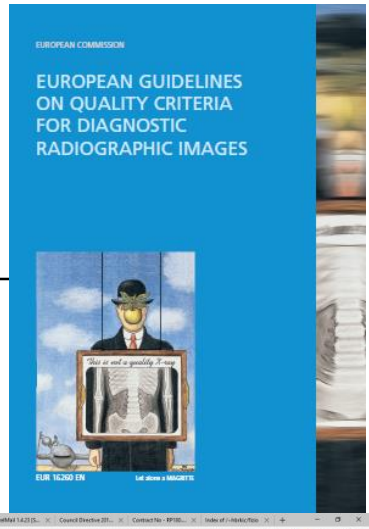
laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom

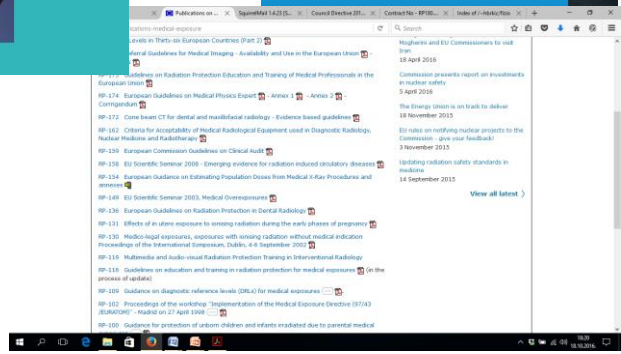
Article 64

Estimates of population doses

Member States shall ensure that the distribution of individual dose estimates from medical exposure for radiodiagnostic and interventional radiology purposes is determined, taking into consideration where appropriate the distribution by age and gender of the exposed.









Dose DataMed2: metodologija RP 154

$$E = \sum_{i=1}^{n} F_i D_i$$

E-kolektivna doza
F-broj postupaka u godini za određeni radiodijagnostički postupak
D-reprezentativna doza za određeni radiodijagnostički postupak
n-broj radiodijagnostičkih postupaka uključenih u procjenu kolektivne doze

Overutilization?

- 20%–50% postupaka DR ne daju informaciju koja poboljšava pacijentovo stanje: Opravdanost???



Addressing Overutilization in Medical Imaging[1]

Radiology

William R. Hendee, PhD
Gary J. Becker, MD
James P. Borgstede, MD
Jennifer Bosma, PhD
William J. Casarella, MD
Beth A. Erickson, MD
C. Douglas Maynard, MD
James H. Thrall, MD
Paul E. Wallner, DO

The growth in medical imaging over the past 2 decades has yielded unarguable benefits to patients in terms of longer lives of higher quality. This growth reflects new technologies and applications, including high-tech services such as multisection computed tomography (CT), magnetic resonance (MR) imaging, and positron emission tomography (PET). Some part of the growth, however, can be attributed to the overutilization of imaging services. This report examines the causes of the overutilization of imaging and identifies ways of addressing the causes so that overutilization can be reduced. In August 2009, the American Board of Radiology Foundation hosted a 2-day summit to discuss the causes and effects of the overutilization of imaging. More than 60 organizations were represented at the meeting, including health care accreditation and certification entities, foundations, government agencies, hospital and health systems, insurers, medical societies, health care quality consortia, and standards and regulatory agencies. Key forces influencing overutilization were identified. These include the payment mechanisms and financial incentives in the U.S. health care system; the practice behavior of referring physicians; self-referral, including referral for additional radiologic examinations; defensive medicine; missed educational opportunities when inappropriate procedures are requested; patient expectations; and duplicate imaging studies. Summit participants suggested several areas for improvement to reduce overutilization, including a national collaborative effort to develop evidence-based appropriateness criteria for imaging; greater use of practice guidelines in requesting and conducting imaging studies; decision support at point of care; education of referring physicians, patients, and the public; accreditation of imaging facilities; management of self-referral and defensive medicine; and payment reform.

©RSNA, 2010

[1]From the Departments of Radiology (W.R.H.), Radiation Oncology (W.R.H., B.A.E.), Biophysics (W.R.H.), and Population Health (W.R.H.), Medical College of Wisconsin, 8701 W Watertown Plank Rd, Milwaukee, WI 53226-4801; American Board of Radiology, Tucson, Ariz (G.J.B.); Department of Radiology, University of Colorado, Denver, Colo (J.P.B.);

Istraživanje tipične prakse i doze u RH za pojedine postupke

Radiation Protection Dosimetry (2008), Vol. 131, No. 4, pp. 535–540
Advance Access publication 21 October 2008

SURVEY OF MAMMOGRAPHY PRACTICE IN CI EQUIPMENT PERFORMANCE, IMAGE QUALIT

Dario Faj[1,*], Dario Posedel[2], Damir Štimac[1], Zdravko Ivezić[1], Mladen Kasaba
Dragan Kubelka[3], Vesna Ilakovac[4], Zoran Brnić[5] and Olivera Ciraj Bjelac[6]
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[5]University Hospital Merkur, 10000 Zagreb, Croatia
[6]Vinca Institute of Nuclear Sciences, M.P. Alasa 12–14, Vinca, 11000 Belgrade

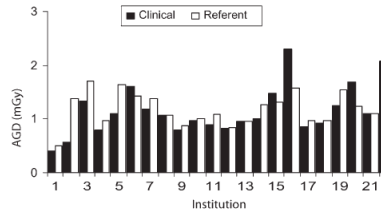


Figure 5. Results of AGD assessment for the standa
breast in the clinical (black) and referent (wh

Radiation Protection Dosimetry (2009), pp. 1–7
doi:10.1093/rpd/ncp237

NOTE

PATIENT RADIATION DOSES IN THE MOST COMMON INTERVENTIONAL CARDIOLOGY PROCEDURES IN CROATIA: FIRST RESULTS

Z. Brnić[1,*], T. Krpan[2], D. Faj[3], D. Kubelka[4], J. Popić Ramač[1], D. Posedel[5], R. Steiner[6], V. Vidjak[1], V. Brnić[7], K. Višković[8] and V. Baraban[6]
[1]Department of Radiology, University Hospital Merkur, Zajčeva 19, 10000 Zagreb, Croatia
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[5]...000 Zagreb, Croatia
[6]...spital of Osijek, J. Huttlera 4, 31000 Osijek, Croatia
[7]...Salata 3b, 10000 Zagreb, Croatia

Table 2. Measurements of KAP, FT and *F* for CA and PTCA, respectively, with proposed local DRLs and national preliminary DRLs in comparison with DRLs proposed earlier at European level[4, 23].

	KAP (Gy cm^2)		FT (min)		*F*
	Mean ± SD (range)	Rounded third quartile	Mean ± SD (range)	rounded third quartile	
CA					
Hospital A	25.9 ± 0.2 (0.8–112.4)	32	4.9 ± 3.9 (1.0–18.1)	6.3	
Hospital B	15.5 ± 12.6 (2.2–57.8)	29	5.1 ± 4.5 (1.1–17.0)	5.5	
Hospital C	16.6 ± 13.6 (1.3–66.8)	22	6.0 ± 6.8 (0.5–29.9)	7.2	
Hospital D	43.3 ± 28.2 (10.6–129.2)	46	5.9 ± 5.5 (1.3–23.5)	7.2	
All hospitals	Average 25.3	National DRL = 32	Average 5.5	National DRL = 6.6	
European DRL[4]		57		6	
European DRL[23]		45		6.5	
	)–	79	16.1 ± 9.7 (3.0–39.4)	19	
	–157.0)	70	13.6 ± 8.3 (1.8–32.0)	16	
	–77.9)	55	13.1 ± 9.9 (1.3–43.5)	18	
	1–	85	19.3 ± 12.0 (5.8–45.4)	23	
		National DRL = 72	Average 15.5	National DRL = 19	
		94		16	
		85		15.5	

Pediatric Imaging • Original Research

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]

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 scanning

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
tion of patients and staff during interventional p
and Europe.
SUBJECTS AND METHODS. In a multi
radiation protection tools, peak skin dose (PSD),
vided by 55 hospitals in 20 mainly developing cou
in Africa, and six in Asia).
RESULTS. Nearly 40% of the interventional
2,000 patients. It is remarkable that the workload
reach the levels of adult procedures even in devel
ing countries have shown a 100% increase in work
participating rooms. Even though KAP was availa
experience in its use. One hundred of 505 patient
2-Gy threshold for deterministic effects.

European Journal of Radiology xxx (2011) xxx–xxx
Contents lists available at ScienceDirect
European Journal of Radiology
journal homepage: www.elsevier.com/locate/ejrad

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], Madan M. Rehani[g,*]
[a] Vinca Institute of Nuclear Sciences, Belgrade, M.P.Alasa 12-14, Vinca, Serbia
[b] University of Sarajevo, Institute of Radiology, Bolnicka 25, Sarajevo, Bosnia and Herzegovina
[c] University Hospital Osijek, Josipa Huttlera 4, Osijek, Croatia
[d] University of Skopije, Institute of Radiology, Vodnjanska 17, Skopje, The Former Yugoslav Republic of Macedonia
[e] Clinical Centre of Montenegro, Ljubljanska bb, Podgorica, Montenegro
[f] International Atomic Energy Agency, Wagramer Strasse 5, Vienna, Austria

Contents lists available at ScienceDirect
European Journal of Radiology
journal homepage: www.elsevier.com/locate/ejrad

Good reasons to implement quality assurance in nationwide breast cancer screening programs in Croatia and Serbia: Results from a pilot study

Olivera Ciraj-Bjelac[a,*], Dario Faj[b,1], Damir Stimac[b,2], Dusko Kosutic[a,3], Danijela Arandjic[a,4], Hrvoje Brkic[c,5]

Istraživanje broja postupaka u DIR i tipične prakse

- https://civilna-zastita.gov.hr/UserDocsImages//dokumenti/Radioloska%20i%20nuklearna%20sigurnost/Procjene,%20istrazivanja%20i%20analize//Procjena%20medicinskog%20ozra%C4%8Denja%20stanovni%C5%A1tva%20RH.pdf

Istraživanje broja postupaka u DIR i tipične prakse

- Tipično ozračenje pacijenta i DRL u svim istraženim modalitetima u okviru je publiciranih rezultata i rezultata u ostalim EU državama
- Detaljnija analiza pokazuje veliku raznolikost radiološke prakse u DIR i DENT, za razliku od NM gdje je praksa prilično ujednačena.
- Omjer maksimalnog i minimalnog ozračenja pacijenta za isti modalitet doseže i više desetaka
- Razlike zbog tehnoloških razlika u opremi ali ponajviše zbog načina rada
- Potrebno ujednačavanje prakse i njena optimizacija, kao i edukacija iz područja zaštite pacijenta od ionizirajućeg zračenja (posebno CT)

EC RP180

RADIATION PROTECTION N° 180

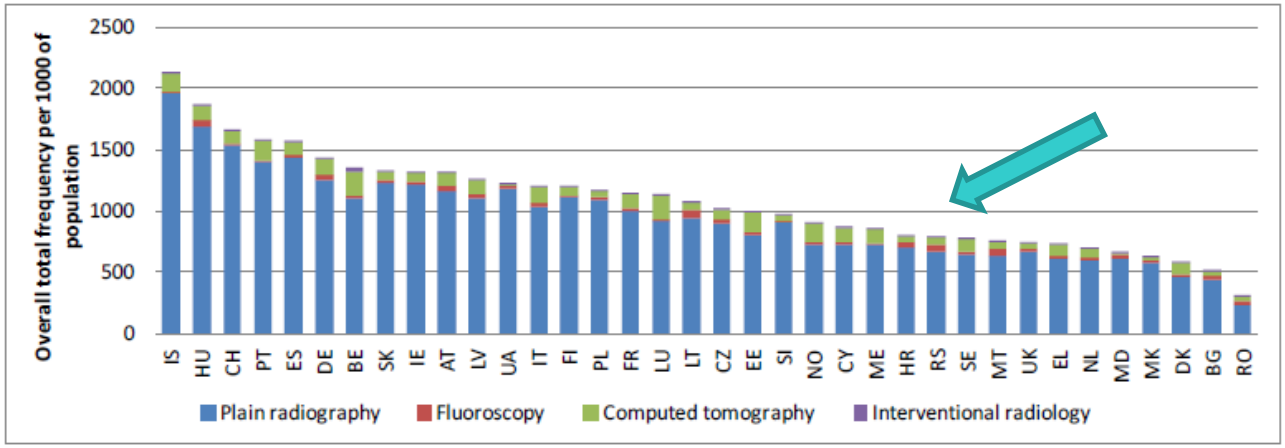


Figure 5.1. Overall total frequencies per 10 relative contributions of the four main groups (p computed tomography and interventional ra includes dental procedures.

Medical Radiation Exposure of the European Population

Part 1/2

Directorate-General for Energy
Directorate D — Nuclear Safety & Fuel Cycle
Unit D3 — Radiation Protection
2014

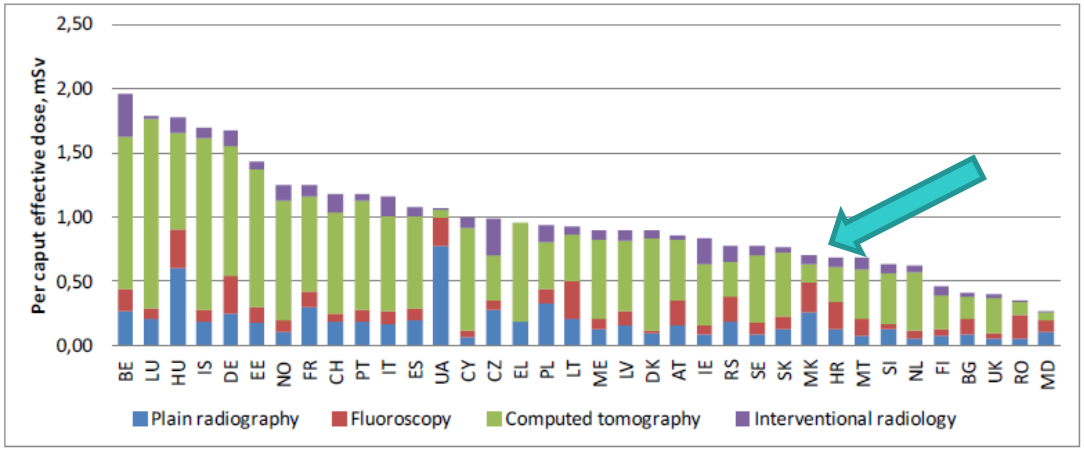
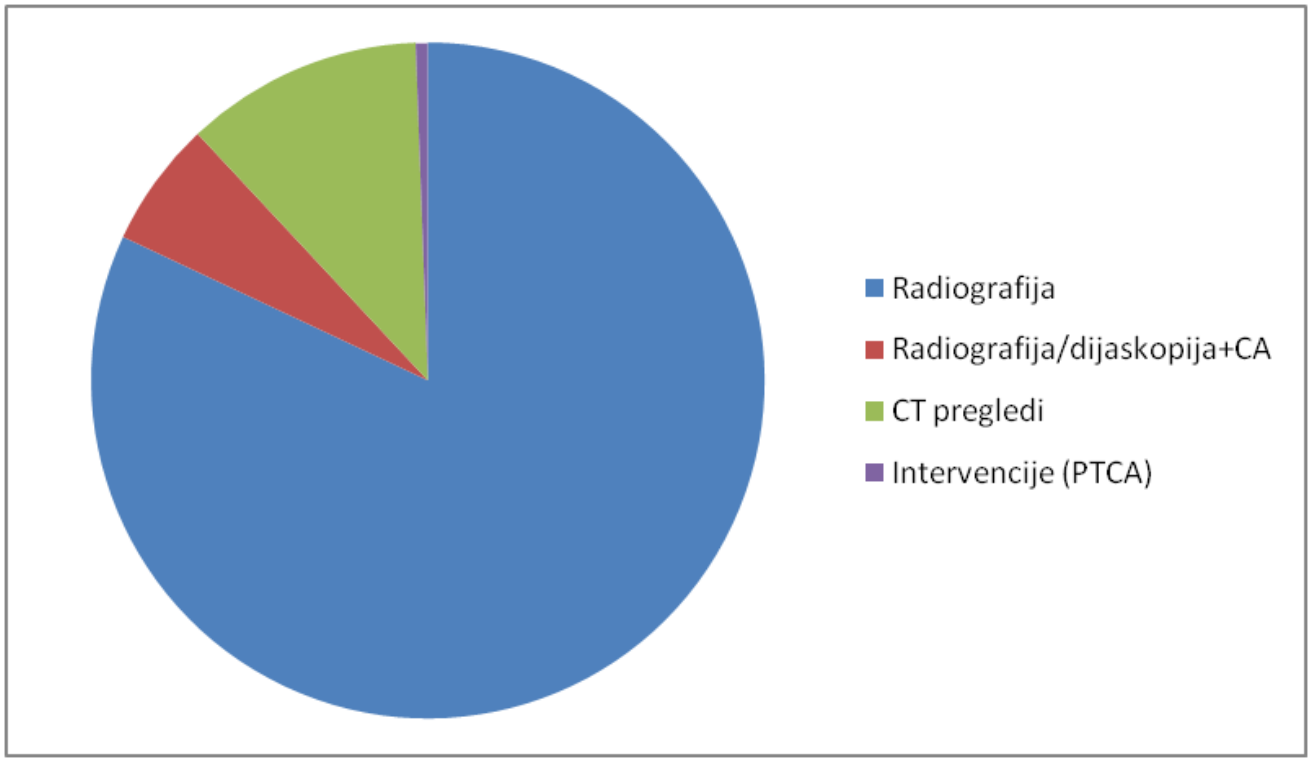


Figure 5.11. Per caput effective doses for different countries. The relative contributions of the four main groups (plain radiography, fluoroscopy, computed tomography and interventional radiology) are also shown (for more details on relative contributions, see Table 5.22). For EL, data for the contributions of fluoroscopy and IR were not available.

Medicinsko ozračenje u RH

- 3.260.000 radioloških i 41.700 NM dijagnostičkih postupaka u 2010 ~ 800 pregleda na 1000 stanovnika godišnje
- Ukupno 2500 manSv godišnje ~ 0.7mSv/y po stanovniku
- Prava vrijednost ovih podataka nije samo u procjeni rizika nego u trajnom praćenju i kontroli ukupnog medicinskog ozračenja obzirom na potencijal štetnih zdravstvenih efekata

Broj postupaka u RH - rezultati

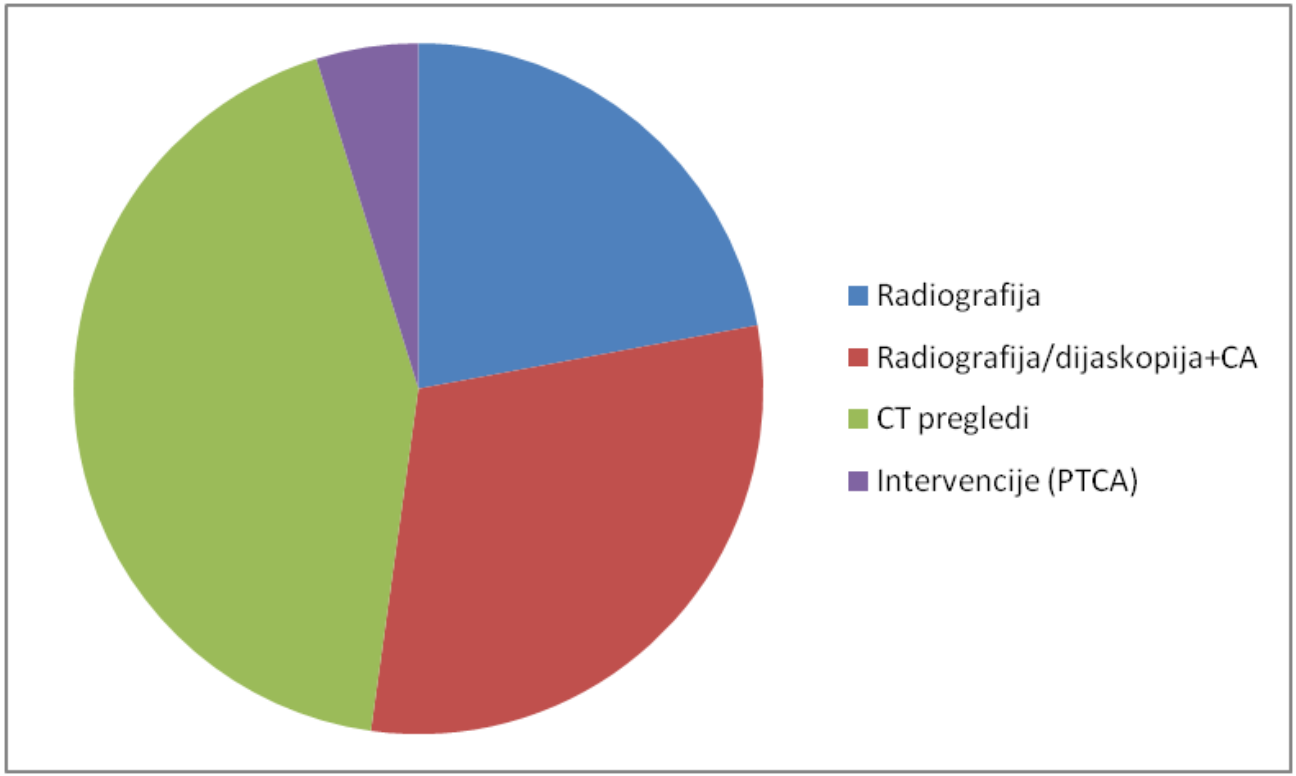


Doprinos glavnih grupa medicinskih postupaka koji koriste ionizirajuće zračenje ukupnom broju pregleda

TIPIČNE EFEKTIVNE DOZE - Referral criteria for imaging, update 2008, RP 118

Dijagnostički postupak	Tipična efektivna doza (mSv)	Ekvivalentni broj PA snimki pluća	Prosječan ekvivalentni period pozadinskog zračenja
Pluća (jedna PA snimka)	0.02	1	3 dana
Lubanja	0.07	3.5	11 dana
Torakalna kralježnica	0.7	35	4 mjeseca
Lumbalna kralježnica	1.3	65	7 mjeseci
Kuk	0.3	15	7 tjedana
Zdjelica	0.7	35	4 mjeseca
Abdomen	1.0	50	6 mjeseci
IVU	2.5	125	14 mjeseca
Barium swallow	1.5	75	6 mjeseci
Barium meal	3	150	16 mjeseci
Barium follow through	3	150	16 mjeseci
Barium enema	7	350	3.2 godine
CT glave	2.3	115	1 godina
CT prsa	8	400	3.6 godine
CT Abdomena ili zdjelice	10	500	4.5 godine

Efektivna doza u RH



Doprinos glavnih grupa medicinskih postupaka koji koriste ionizirajuće zračenje ukupnoj kolektivnoj dozi

Zaključak

- Medicinsko ozračenje u RH u skladu je s EU podatcima i trendovima i iznosi oko 20%ukupnog ozračenja populacije RH
- Velika nesigurnost u prikupljenim podatcima zbog neujednačene prakse:
  - Potrebno uskladiti radiološku praksu u RH s pravilima dobre prakse
  - Uvesti sustave osiguranja kvalitete
  - Edukacija






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