



NATIONAL SURVEY IN NUCLEAR MEDICINE IN BULGARIA





Survey in Nuclear Medicine - purposes

- DRLs for administered activities
- Frequency of examinations
- Population dose estimate from NM

Performed in 2008

Based on data from 2007

"Strengthening of administrative structures
for radiation protection and safety use
of ionizing radiation in diagnostics and therapy"

http://ncrrp.org/projects/bg-fin/index_en.html



OBJECTIVE:

Strengthening of the administrative and institutional health care structures in Bulgaria in regard to the radiation protection, reduction of the radiation exposure of the population at medical use of ionizing radiation as required in the EC Basic Safety Standards 96/29 EUROATOM and the Medical Exposures Directive 97/43/EUROATOM, raising the level of the medical services and by this approaching a better quality of life.

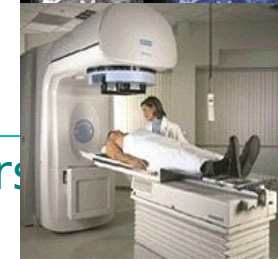
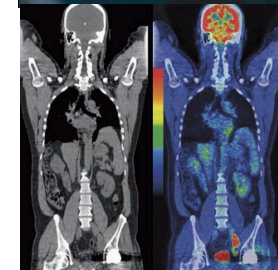
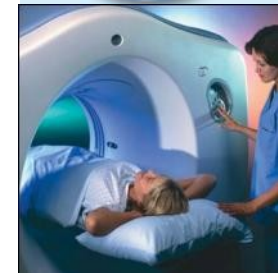
PURPOSES:

1. Modernizing the Secondary Standard Dosimetry Laboratory in accordance to the EC requirements
2. Applying comprehensive QA policy radiotherapy
- 3. Optimising patient radiation protection in Diagnostic Radiology and Nuclear Medicine**

PERIOD:

20 May 2008 – 19 May 2009 г.

PROJECT PARTNER Radiation and Nuclear Safety Authority (STUK)





Methodology

Questionnaire developed by NCRRP in collaboration with NM society (based on STUK experience)

Hospital

Department

Address

Phone number

Name

Date

Signature



Methodology

Questionnaire

- NM equipment for in vivo examinations

<i>Equipment</i>	<i>Model</i>	<i>Year of installation</i>
Planar SPECT activity meters...		

Quality control of imaging equipment, activity meters,
radiopharmaceuticals

<i>Tested parameter</i>	<i>Period</i>	<i>Who performs the test</i>	<i>Acceptance criteria</i>



Methodology

Questionnaire

- Nuclear medicine examinations, adults
- a) Imaging examinations

	<i>Examination</i>	<i>Nuclide</i>	<i>Radiopharmaceutical</i>	<i>Activity (MBq)</i>	<i>Number of examinations in 2007</i>
Bone	Bone imaging (planar)	^{99m} Tc	MDP		
	Bone imaging (SPECT)	^{99m} Tc	MDP		
	Bone marrow imaging	^{99m} Tc	nanocolloid		
	Inflammation imaging	^{99m} Tc	HMPAO		
Lung	Lung perfusion	^{99m} Tc	macroalbumin		



Methodology

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	<i>Examination</i>	<i>Nuclide</i>	<i>Radiopharmaceutical</i>	<i>Mean activity (MBq)</i>	<i>Number of examinations in 2007</i>
Gastrointestinal tract	Liver/spleen	^{99m} Tc	sulfocolloid		
	Meckel's diverticulum	^{99m} Tc	pertechnetate		
	Liver-gall scintigraphy	^{99m} Tc	HIDA		
	Gastric emptying	^{99m} Tc	sulfocolloid		
	Lachrymal gland	^{99m} Tc	Tc-pertechnetate		
	Oesophageal transition	^{99m} Tc	colloid		



Methodology

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	<i>Examination</i>	<i>Nuclide</i>	<i>Radiopharmaceutical</i>	<i>Mean activity (MBq)</i>	<i>Number of examinations in 2007</i>
Kidneys and Urinary system	Kidneys scintigraphy	^{99m}Tc	DTPA		
	Kidneys scintigraphy	^{99m}Tc	MAG3		
	Mantle of adrenal	^{99m}Tc	DMSA		
Heart	Radionuclide ventriculography	^{99m}Tc	Pertechnetate		
	Myocardium perfusion	^{99m}Tc	MIBI tetrofosmine Stress rest		
	Cerebral perfusion	^{99m}Tc	HMPAO		



Methodology

Questionnaire

- Nuclear medicine examinations, adults
 - a) Imaging examinations

	<i>Examination</i>	<i>Nuclide</i>	<i>Radiopharmaceutical</i>	<i>Mean activity (MBq)</i>	<i>Number of examinations in 2007</i>
Endocrine system	Thyroid scintigraphy	^{99m}Tc	Pertechnetate		
	Thyroid metastases (after thyroid ablation)	^{131}I	Sodium chloride		
	Parathyroid glands scintigraphy	^{99m}Tc	MIBI (tetrophosmine)		
	Adrenal gland scintigraphy	^{131}I	MIBG		



Methodology

Questionnaire

- Nuclear medicine examinations, adults
 - a) Imaging examinations

	<i>Examination</i>	<i>Nuclide</i>	<i>Radiopharmaceutical</i>	<i>Mean activity (MBq)</i>	<i>Number of examinations in 2007</i>
Tumours scintigraphy	Somatostin receptor scintigraphy	¹¹¹ In	Octreotid (tetrophosmine)		
	Mammary gland	^{99m} Tc	MIBI (tetrophosmine)		
	Tumour	¹²³ I	MIBG		
	Lymphatic system	^{99m} Tc	Colloid		
	Other				





Methodology

Questionnaire

- Nuclear medicine examinations, adults
 - b) Non-Imaging examinations

	<i>Examination</i>	<i>Nuclide</i>	<i>Radiopharmaceutical</i>	<i>Mean activity (MBq)</i>	<i>Number of examinations in 2007</i>
Hematology	Survival of Er	⁵¹ Cr	labelled erythrocyte		
	Volume of Er	^{99m} Tc	labelled erythrocyte		

- Nuclear medicine examinations, children
 - a) Imaging examinations
 - b) Non-Imaging examinations
- Nuclear medicine therapy procedures



Methodology

Questionnaire in electronic form sent to all NM departments in the country (19)

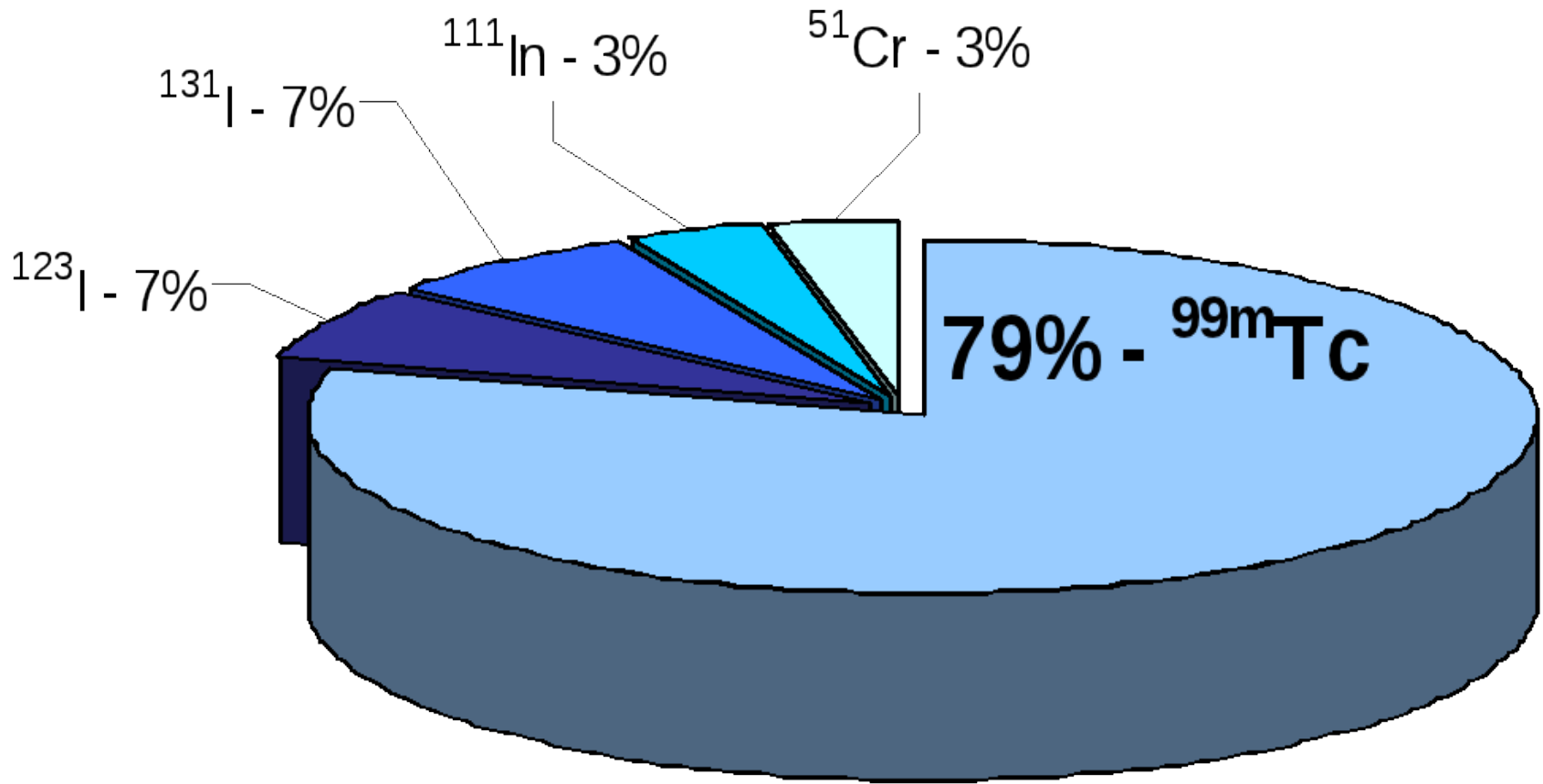
All responded (by e-mail or post)

Database at NCRRP

Analysis done by NCRRP

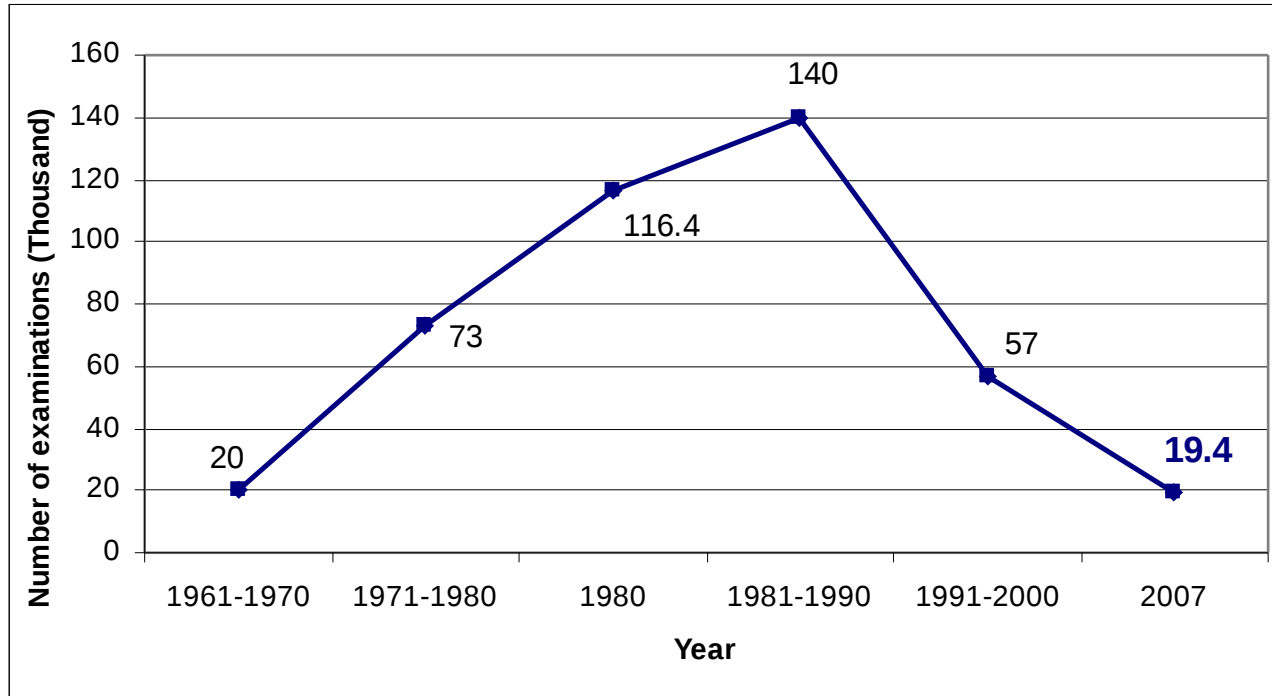


Diagnosics adults





Diagnostics



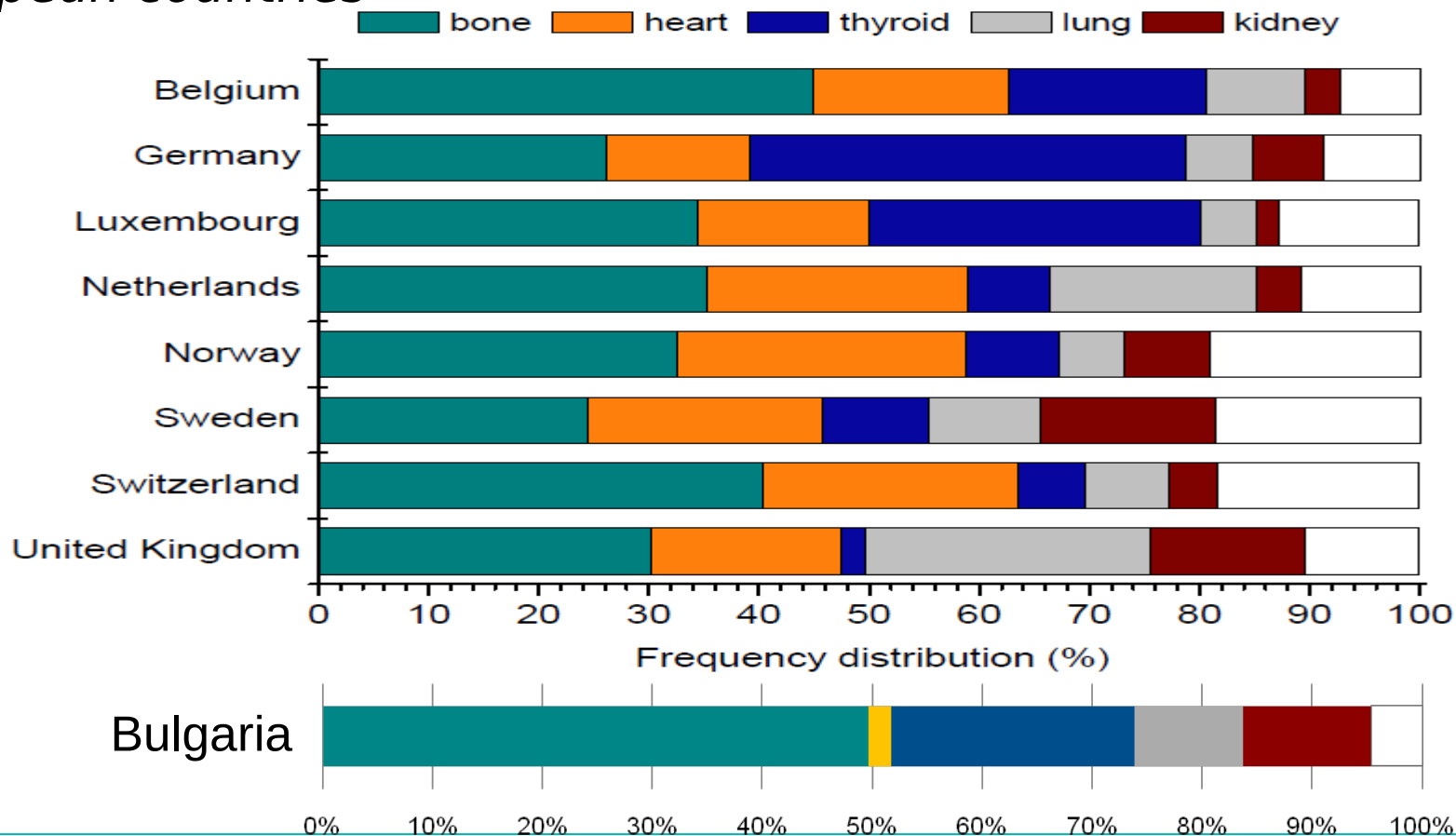
2.6 NM examinations per 1000 (2007)

56 in Belgium
11 in UK
7.7 in Finland



RP 154 ANNEX 2 – Dose Datamed Report 1a. Review of national surveys of population exposure from nuclear medicine examinations in eight European countries

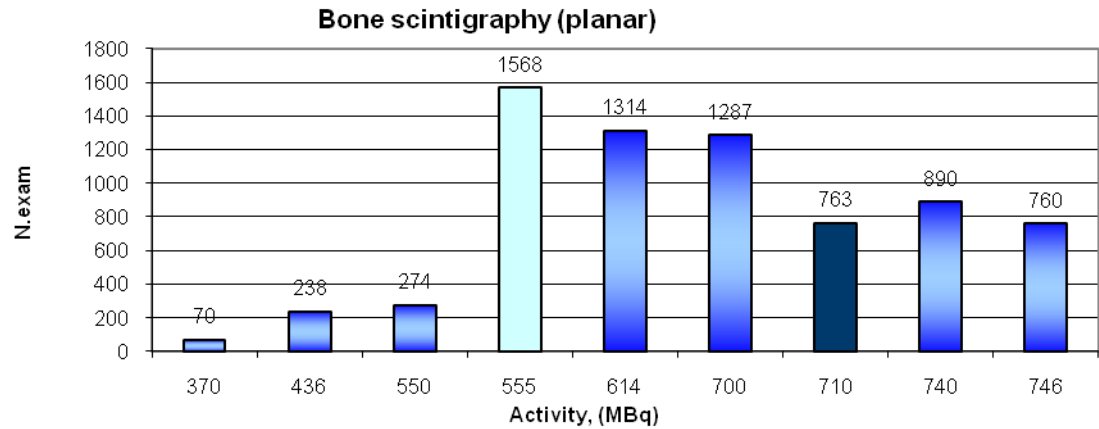
Frequency of NM examinations



DRL

Bone scintigraphy – planar imaging

Department	Administered activity (MBq)	Numbers
1	370	70
2	463	238
3	550	274
4	555	440
5	555	147
6	555	460
7	555	521
8	614	1314
9	700	1287
10	740	116
11	740	774
12	746	760
Total:	4090290	6401



Weighed average	639 MBq
Mode	555 MBq
Third quartile	710 MBq

DRL – 640 MBq

Effective dose

■ For every examination category: Average weighted activity

$$\bar{A}_{np} = \frac{A_1 \cdot n_1 + A_2 \cdot n_2 + \dots + A_k \cdot n_k}{n} \quad , \quad [\text{MBq}]$$

■ Average effective dose

$$\bar{E} = \bar{A}_{np} \cdot f \quad , \quad [\text{mSv}]$$

f - conversion coefficient, [mSv/MBq]

- **ICRP Publication 53** - Biokinetics and Dosimetry: General Considerations
- **ICRP Publication 80** - Radiation Dose to Patients from Radiopharmaceuticals

Highest effective doses

<i>Examination</i>	<i>nuclide</i>	<i>radiopharmaceuticals</i>	Effective dose, mSv
Radionuclide ventriculography	^{99m}Tc	Pertechnetat	9.62
Myocardium perfusion	^{99m}Tc	MIBI (rest)	8.21
Thyroid metastases (after thyroid ablation)	^{131}I	Iodide	7.00
Inflammation imaging	^{99m}Tc	HMPAO	6.88
Mammary gland	^{99m}Tc	MIBI	5.71
Cerebral receptors	^{123}I	DatScan	5.39
Parathyroid glands scintigraphy	^{99m}Tc	MIBI	4.73
Cerebral perfusion	^{99m}Tc	HMPAO	4.65
Bone scintigraphy -SPECT	^{99m}Tc	MDP	4.05





	Type of examination	Radionuclide	Radiopharmaceutical	Number of examinations	Total activity (MBq)	Weighted average administered activity, MBq	Conversion factor, mSv.MBq ⁻¹	Effective dose per examination, mSv	Collective dose, manSv (% from the total)
Bones	Bone scintigraphy (planar)	^{99m} Tc	MDP	6401	4090290	639	5.70E-03	3.64	23.31 (43.38)
	Bone scintigraphy -SPECT	^{99m} Tc	MDP	3193	2252736	706	5.70E-03	4.02	12.84 (23.89)
	Marrow scintigraphy	^{99m} Tc	nanocolloid	15	5550	370	9.70E-03	3.59	0.054 (0.10)





Population dose

