



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:

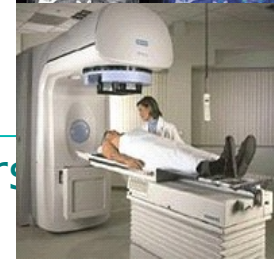
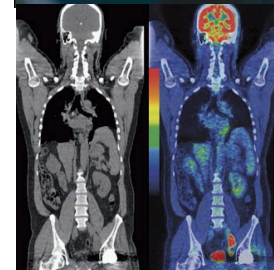
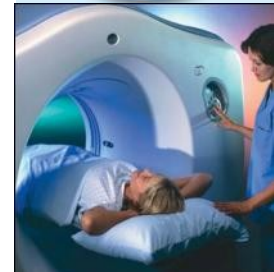
1. Modernizing the Secondary Standard Dosimetry Laboratory in accordance to the EC requirements
2. Applying comprehensive QA policy radiotherapy
- 3. Optimising patient radiation protection in Diagnostic Radiology and Nuclear Medicine**

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

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> |
|-------------------------------|-------------------------|-------------------|----------------------------|----------------------------|---------------------------------------|
| 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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|-----------------------------------|-------------------------------|-------------------|-------------------------------------|----------------------------|---------------------------------------|
| 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)

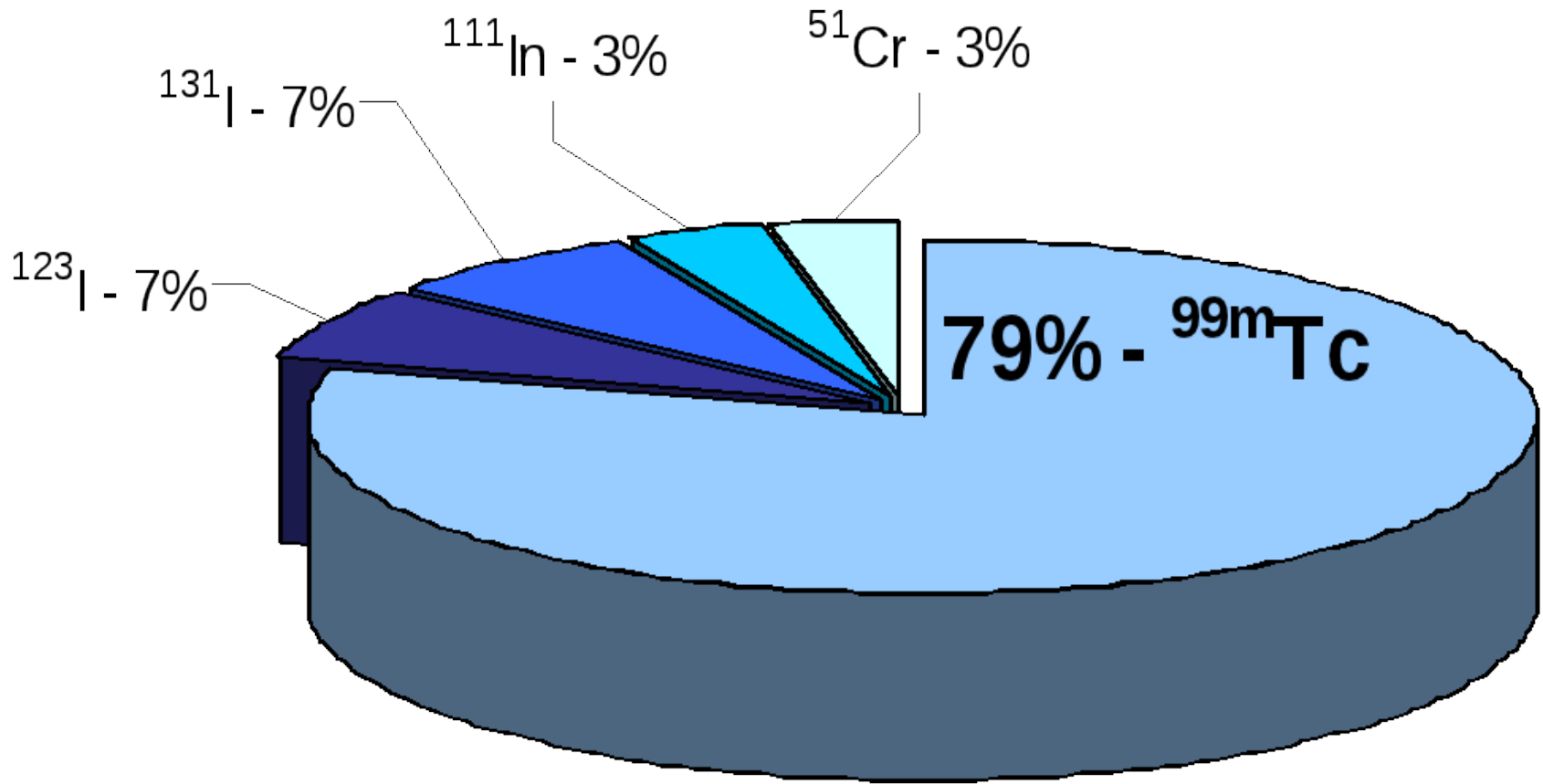
Database at NCRRP

Analysis done by NCRRP



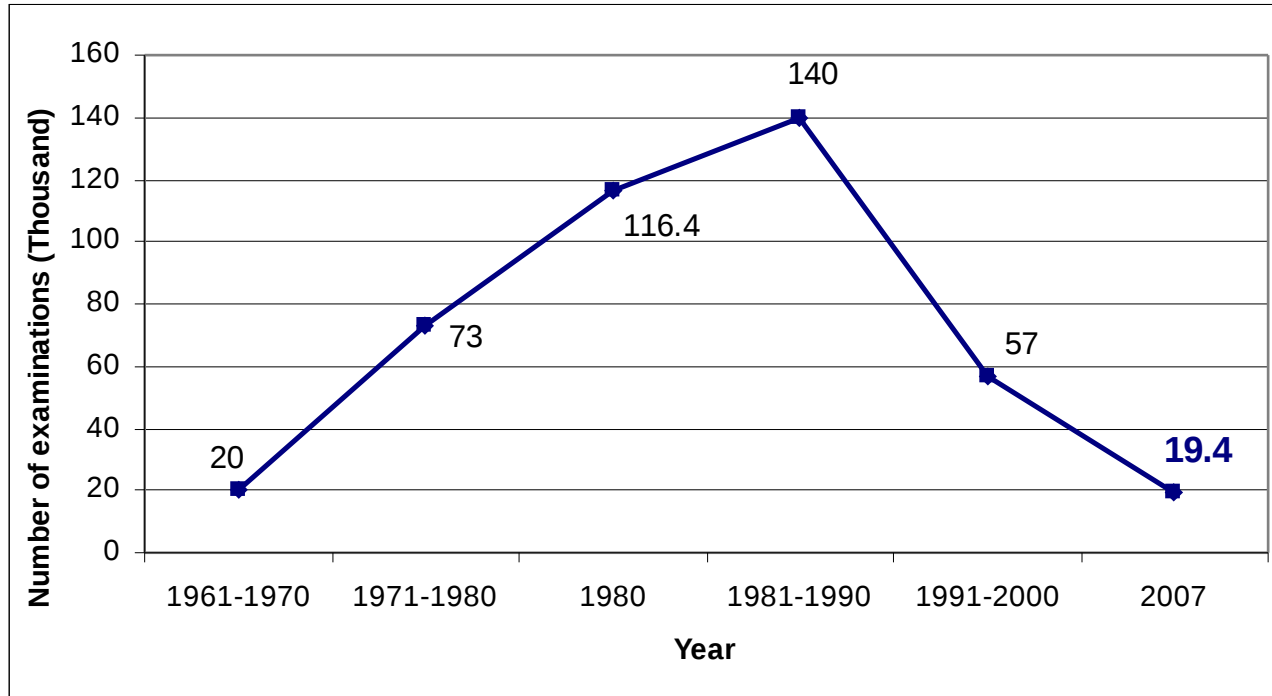


Diagnostics adults





Diagnostics



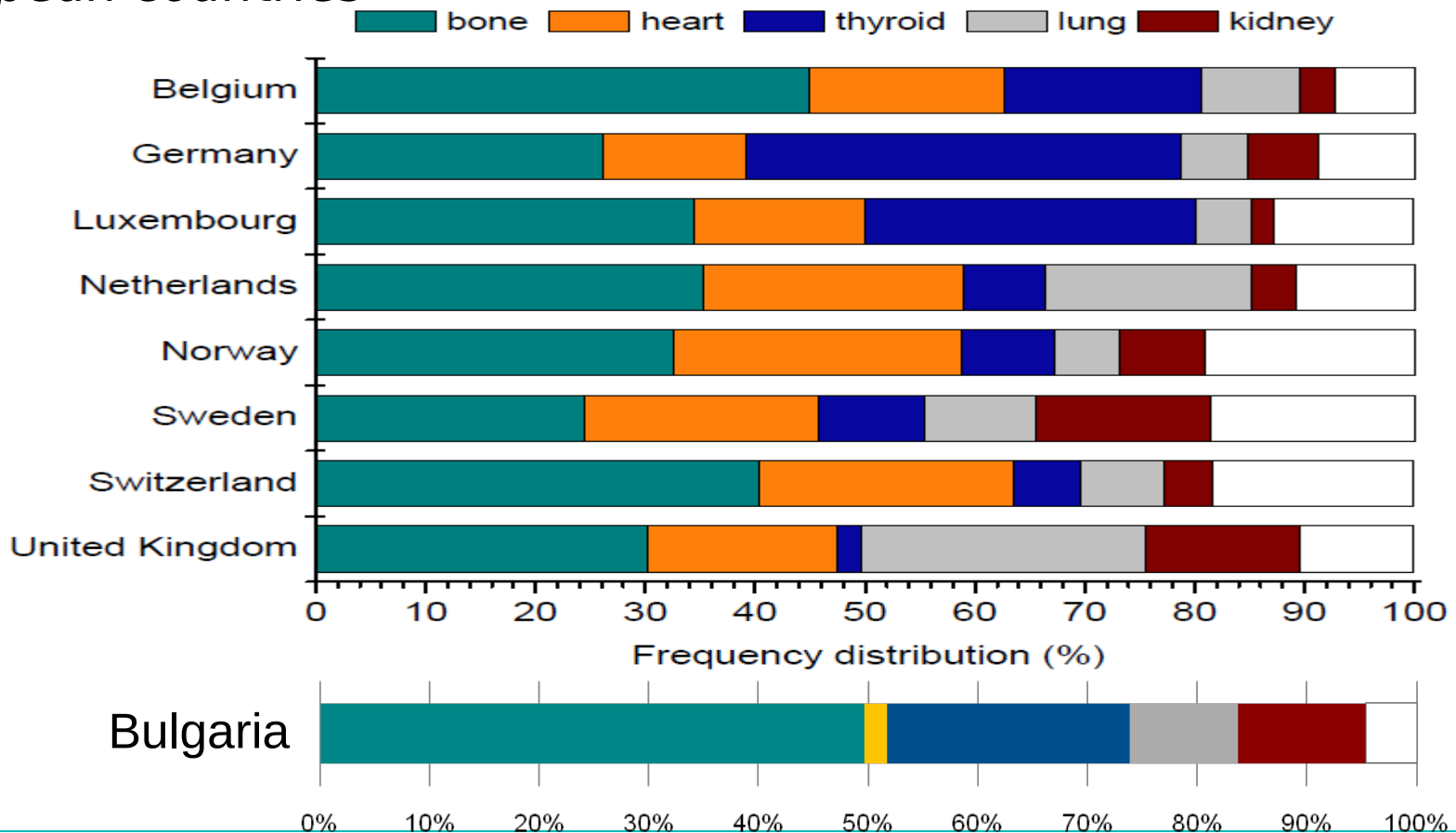
2.6 NM examinations per 1000 (2007)

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

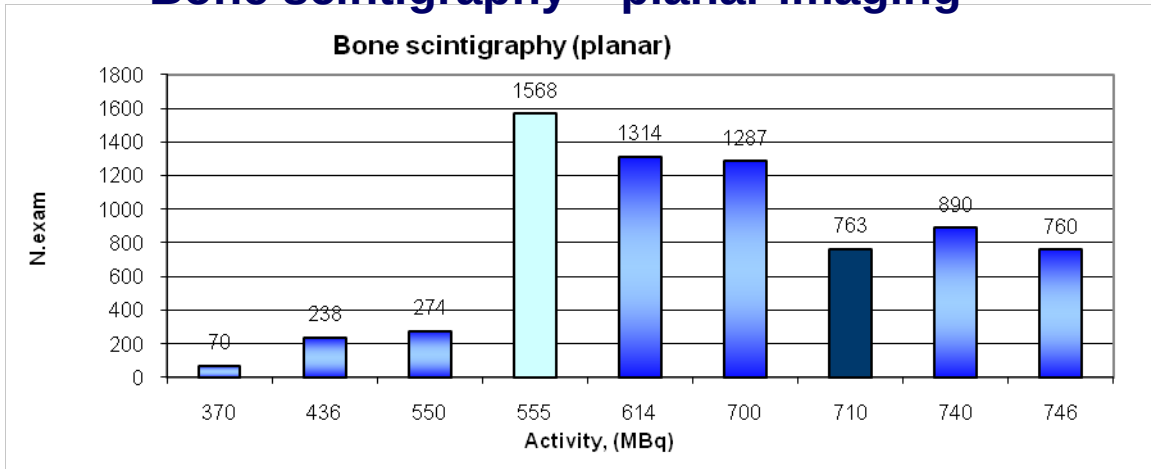
Frequency of NM examinations



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

