Population doses from x-ray and nuclear medicine procedures in Nordic countries

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Nordic group on medical applications
DoseDatamed 2 collected data from 36 European countries

Published in EU RP 180
Medical Radiation Exposure of the European Population
RELATIVE CONTRIBUTION TO THE POPULATION DOSE IN NORDIC COUNTRIES AND IN EUROPE

Nordic countries

- CT: 72%
- Fluoroscopy: 8%
- Radiography: 10%
- Interventional: 9%
- NM: 5%

Europe

- CT: 52%
- Fluoroscopy: 13%
- Radiography: 22%
- Interventional: 8%
- NM: 5%
RELATIVE CONTRIBUTION TO THE POPULATION DOSE IN AUSTRALIA AND USA

Hayton et al. Radiation Protection Dosimetry (2013), pp. 1–6

NCRP Report Number 160
COLLECTIVE EFFECTIVE DOSES

Collective effective dose per caput (mSv)

- IS
- NO
- DK
- SE
- FI

- Plain radiography
- Fluoroscopy
- Interventional radiology
- Nuclear medicine
- Computed tomography
WHAT DOES POPULATION DOSE INDICATE?

HIGHER collective effective dose may indicate
• higher frequencies of procedures
• unjustified procedures?
• more use of high dose procedures
• unoptimized procedures

LOWER collective effective dose may indicate
• lower frequencies of procedures
• not adequate availability of equipment according to good medical practice
• optimized procedures
DOSES FROM X-RAY AND NM PROCEDURES

All 36 European countries included in this survey: 636,100 manSv, resulting in a mean effective dose of 1.1 mSv per caput.

EU-countries and EFTA countries (Norway, Iceland and Switzerland): 578,200 manSv, resulting in a mean effective dose of 1.1 mSv per caput.

Nordic countries: 21,924 manSv, resulting in a mean effective dose of 0.87 mSv per caput.
X-RAY: COLLECTIVE EFFECTIVE DOSES per caput

Per caput effective dose, mSv

Plain radiography
Fluoroscopy
Computed tomography
Interventional radiology
Overall total frequency per 1000 of population

European average: 1 examination per person per year
RELATIVE FREQUENCIES OF CT

[Bar chart showing relative frequencies for various countries, with flags indicating different regions.]
X-RAY: MEAN EFFECTIVE DOSES

CT spine

Range 2-16 mSv; max/min 6
Nordic range 6-13 mSv
X-RAY: MEAN EFFECTIVE DOSES

CT abdomen

Range 3-29 mSv; max/min 11
Nordic range 7-14 mSv
X-RAY: MEAN EFFECTIVE DOSES

CT trunk

Range 2.3-50 mSv; max/min 22
Nordic range 9-50 mSv
X-RAY: MEAN EFFECTIVE DOSES

Range 3-11 mSv; max/min 4
Nordic range 5-8 mSv
X-RAY: MEAN EFFECTIVE DOSES

Range 4-29 mSv; max/min 7
Nordic range 12-20 mSv
NM: COLLECTIVE EFFECTIVE DOSES

NM contribution is 5% to the radiological collective effective dose.
NM: COLLECTIVE EFFECTIVE DOSES

- Bone imaging: 29%
- Tumor imaging PET & PET/CT: 18%
- Thyroid total: 8%
- Heart total: 24%
- Lung perfusion: 6%
- Renal total: 2%
- Infection/inflammation total: 2%
- Parkinsonism total: 1%
- Somatostatin receptors imaging: 3%
- CBF total: 2%
- Miscellaneous remainder: 2%
NM: COLLECTIVE EFFECTIVE DOSES FROM PET-IMAGING

Tumor imaging PET & PET/CT

Collective effective dose (mSv per million population)

- DK: 25000
- FI: 2000
- IS: 0
- NO: 0
- SE: 4000
COLLECTIVE EFFECTIVE DOSE AND DRLs FOR OPTIMIZATION

Bone imaging using Tc-99m

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Collective effective dose (mSv per million inhabitants)
Tools for justification and optimization

- Guidance
- Referral criteria
- DRLs
- Clinical audits
  - Self audits
  - External audits
Thank you for your attention!